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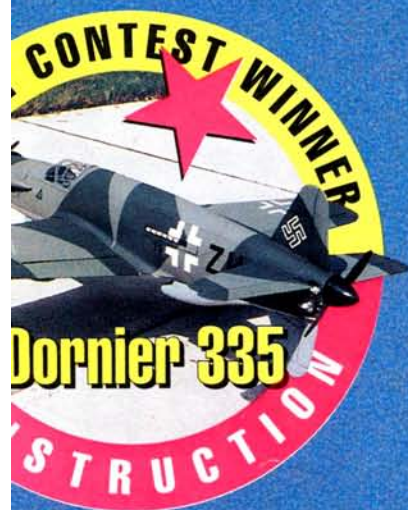
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ON THE COVER: Midwest Model Products' Zero, reviewed in this issue by Jim Simpson, streaks across the sky. (Photo by Dan Parsons.) Inset: Al Masters' Dornier-335 is a scale masterpiece. Don't miss the construction article in this issue.

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EDITORIAL

T O M A T W O O D

EXTENDING THE MODELING HANDSHAKE

IT WAS my pleasure at the 1992 Westchester Radio Aeromodelers Inc., (WRAM) show, held in White Plains, NY, on February 21 to 23, to meet Pawel Wlodarczyk, the manager of the aeromodeling division of the Polish Aero Club, and two club representatives and translators, Matgorzata Kalinowska (photo middle) and Dorota Putrzynska. As in the case of the visit by Soviet modelers last year (see our June '91 issue), the Polish visit was coordinated by Howard Kuhn, an American modeler with many modeling connections in eastern Europe, and by WRAM.

Pawel, a former senior level competitor in F1B and F2C FAI classes, told me that there are approximately 20,000 dues-paying aeromodelers in Poland, and that the most popular categories are free-flight and control-line, followed by R/C, scale modeling and model rocketry. Pawel's group took several fine models to the WRAM show, including two that will compete at the 1992 FAI Scale World Championships to be hosted by the AMA at Muncie, IN, on August 22 to 29.

They expressed warm interest in expanding contacts between Polish and American modelers. They also expressed interest in working with U.S. modeling firms that may wish to export to Poland or to import Polish modeling products. If you're interested in making some new modeling friends in Poland, send your correspondence to Pawel Wlodarczyk, Aeromodeling Manager, Polish Aero Club, 00-071 Warszawa, ul. Krakowskie Przedmiescie 55.

Howard Kuhn, a CIAM (International Aeromodeling Club of the FAI) representative, notes that, with his help and the support of WRAM, Czechoslovakian modelers may visit the WRAM show in the future. We applaud Howard and WRAM for promoting friendship between modelers in different countries. We hope other modeling groups will undertake similar efforts to extend the modeling handshake abroad.

A NOTE FROM THE DOD

We recently received an honor—a "Certificate of Appreciation in support of Operations in the Persian Gulf"—from the U.S. Department of Defense. The certificate, with a DOD seal at



Pawel Wlodarczyk, the manager of the aeromodeling division of the Polish Aero Club, and two club representatives and translators, Matgorzata Kalinowska (photo middle) and Dorota Putrzynska.

its top, is hand-signed by Secretary of Defense Dick Cheney. Since I coordinated shipment of over 100,000 R/C magazines (the majority *Model Airplane News*) to the Persian Gulf (see my August 1991 "Editorial"), I'm fortunate enough to be named on the certificate, along with with Air Age Publishing. Although I spent some time championing this idea and searching for contacts in the military who could expedite shipment of the magazines, that was only a part of the effort.

If you think about where this donation really came from, it's modelers—you the readers—who provide the subjects we cover, and for that matter, who write most of the articles. Without this, there would have been no donation. Credit must also be given to the publishers, Louis and Yvonne DeFrancesco, who were generous enough to donate this sizeable library—valued at over \$300,000—to the cause. World Color Press, Inc., (of New York City) donated the packing for the many tons of magazines so that they

could be shipped to Dover Air Force base to await overseas transportation. All of these players made this shipment possible, and all who participated directly or indirectly can feel proud for having a hand in this effort. The certificate is now posted in the Air Age lobby.

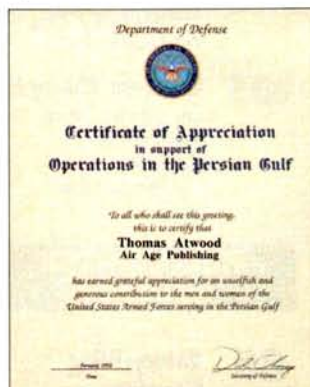
A DEEPER LOOK AT DESIGN

In this issue, we publish the second in a two-part series by Andy Lennon on selecting airfoils. (He also wrote on design for slotted flaps in the October and November '91 issues, and on drag reduction in the January and March '92 issues). The airfoil series may be the most technically sophisticated material we've published in decades, but we know many modelers will be interested in traversing this ground (or at least taking a few steps down the path!). Such fare wasn't uncommon in our pages during the "golden age" of aviation; judging from our survey last year, the mysteries of aerodynamics and design, for many, retain a strong allure.

Andy provides a framework that you can adopt in the search for the best airfoils. These aren't articles that can be easily

understood with a quick reading. Rather, one must make an effort to use the tools they set forth on actual modeling projects. Are we trying to present a course in aeronautical engineering? No, but we do think many modelers who don't have a relevant engineering background would like to be able to make good use of the wealth of information now published on model airfoils—and so Andy's latest

contributions were conceived. If you have specific questions about statements made in these articles, why not drop us a line? We can answer selected questions in our "Airwaves" column or in a follow-up article or series. ■



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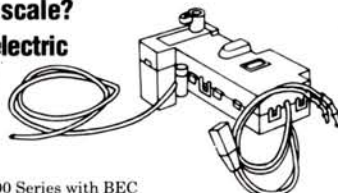
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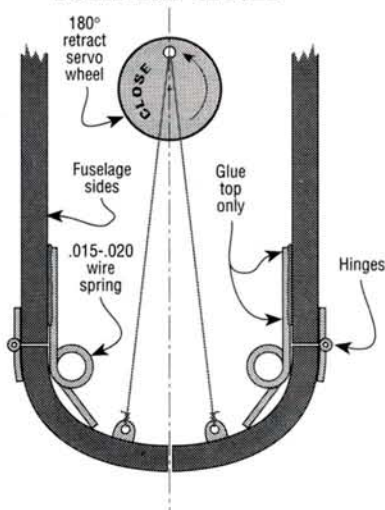
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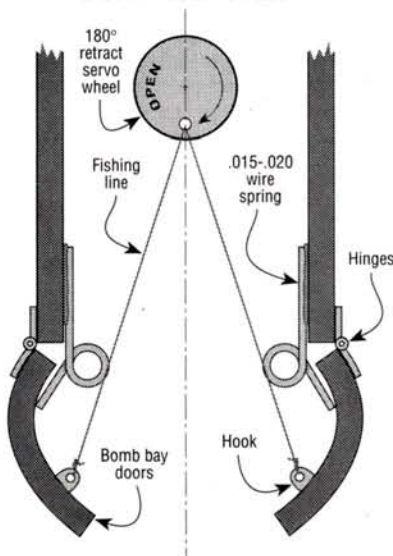
AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," Model Airplane News, 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

BOMB BAY CLOSED



BOMB BAY OPEN



BUILDING BOMB BAYS

I'm building the Royal B-25 and, so far, I've had a few problems to work out, but they've been easy.

I do have one tough nut to crack. You see, I want to operate bomb doors that work from one servo. I've asked Royal Model Products for advice and several hobby retailers, but there just isn't anything available to use as a connection between a servo and the doors!

I'm using a Futaba 7-channel set, and the bomb bay is very large—approximately 4 inches wide, 8 inches long and 2 1/2 inches deep. Can anyone tell me what I need for this plane? I want it to be perfect the first

time I take it to a fun fly.

Many of my club members are looking forward to seeing this plane, even if my instructor has to fly it!

BILL COOVER
Ephrata, PA

Bill, the Royal B-25 is one of those all-time favorites that many modelers like to build and fly, and an operational bomb bay is a logical addition to this kit. First, decide how close to scale you want it to be. A full-scale setup with twin-door actuation requires servo-driven arms and pushrods with swivel links at the ends to operate the doors properly. To avoid binding, the doors have to be hinged perfectly. Since most of this involves scratch-building, I'd build a mockup of the bomber's belly section and "tinker" the linkage together until it works properly.

If sport scale is what you're after, the KISS principle (keep it simple, stupid) is the way to go. Some time ago, I built a sport plane, and I made a simple bomb-bay door that was held open with .015-inch-diameter, spring-steel music wire. I bent the wire into a coil spring so that it resembled a nose landing-gear strut. Then I tied monofilament fishing line to each door and connected the line to a retract servo. When the door was open, the line was slack; when the servo was activated, it pulled the doors shut. It was simple, and except for a broken line or two, the setup operated perfectly for the life of the model.

Another option is to install a pneumatic retract cylinder, and use it to activate the door. Use one for each door of the bomb bay. Whichever method you choose, the work will be well worth the effort. Bombs away!

GY

UNLIMITED COVERAGE

Regarding your coverage of the R/C Unlimited Races at Madera, CA: the races are a great idea, and they should continue, but let's make them safe! Stories of wheels and powerplants falling off planes scare me. Competitors should use steel wire to secure parts to the airframe. Any lawyer will tell you what happens when a plane or a piece of one injures people. This year at Madera, planes will weigh as much as 50 pounds and reach speeds that could approach 200mph.

I give Rob Wood credit for his words on loose gears and unbalanced powerplants, but I saw no mention of balanced control surfaces, i.e., rudders, elevators, ailerons, flaps and combinations thereof. Competitors shouldn't fly without balancing these.

Also, I saw no mention of fail-safe systems, which can prevent accidents. I believe these should include (but not be limited to) an onboard optical warning signal, such as lights or smoke; immediate power-cut-to-idle or pull-up by autopilot (that could land the plane); and a parachute recovery system that's capable of stopping the plane at full power and full speed (the worst case, "greatest load" scenario).

At Madera, fail-safe systems should be demonstrated twice—during or before qualifying and at full speed. I used a similar system when I was in the military, and it worked fine.

Like everyone else, I also have opinions on options. How about relaxing the rules so that eligible planes aren't restricted to known racers? Why not have builders engineer their aircraft? The engineering work would generate numbers that could substantiate the (new) designs' potential ability to qualify, race and win. This could make Madera attractive to sponsors who back Reno racers, and they may try out planes in model size first. Properly managed, unlimited races could potentially mean as much to aviation as the Reno Races and the Schneider Cup.

My background? I've flown models for 15 years and military drones for one year. I'm an aeronautical engineer who's known for screwing up in style: I planned to open the '87 North Norwegian Championships by setting a new endurance distance record. In front of some 100 people, three newspapers and a radio crew, I managed to ditch my plane over the quay-side into the sea (a wheel bearing had frozen on takeoff).

After a frantic 24 hours and with a new carburetor, I proceeded to get my 1/4-scale Aeronca Champion back in the air. Halfway through the program, the chainsaw engine quit. I yelled "landing." Two people were taping my approach. I silenced the speaker, killed the score list, hit a concrete-reinforced semi-trailer, left

(Continued on page 10)

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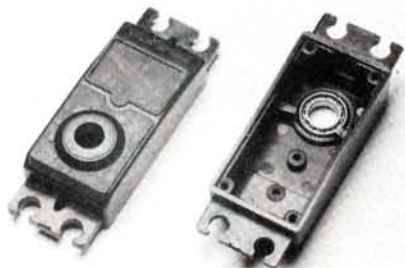
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AIRWAVES

some 15,000 people in the dark, and put my insurance to good use. I did win a prize for these stunts!

ARNT KARLSEN
Norway

Arnt, thanks for your suggestions; they make a lot of sense. The extent to which safety precautions of the scope you've suggested will become accepted practice depends on the organizers of these races. More than one group will be sponsoring unlimited races, and we continue to support the notion that a unified set of rules be adopted.

For those who are interested, the Unlimited is an organization that's coordinating a race that will be held in Madera, CA, on September 23 to 27 (entry deadline is May 1). This event includes both an unlimited and a 1/16-scale AT6 race. For more information, call Leslie Burnett at (310) 320-8369. A second race was confirmed for April 23 to 26 by the R/C Unlimited Racing Association, and for more information on the races this group is organizing, call (602) 722-0607. We intend to offer coverage of all major unlimited races.

Arnt, your letter adds to the discussion, I think, in a helpful way. At least we can say you weren't offering safety advice that wasn't based on your own experience! TA

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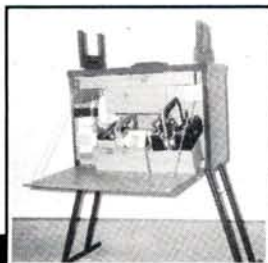
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ALL IN THE FAMILY

Enclosed is a photograph of my family. We're four generations of fliers, all flying at the same field in Flagler Beach, FL. Thought you might be interested, because we recently heard that a magazine had an article on a three-generation family of fliers. I've been the president of the Flagler County Rams for the past four years, and this is the latest picture of yours truly with my dad, Ralph, who

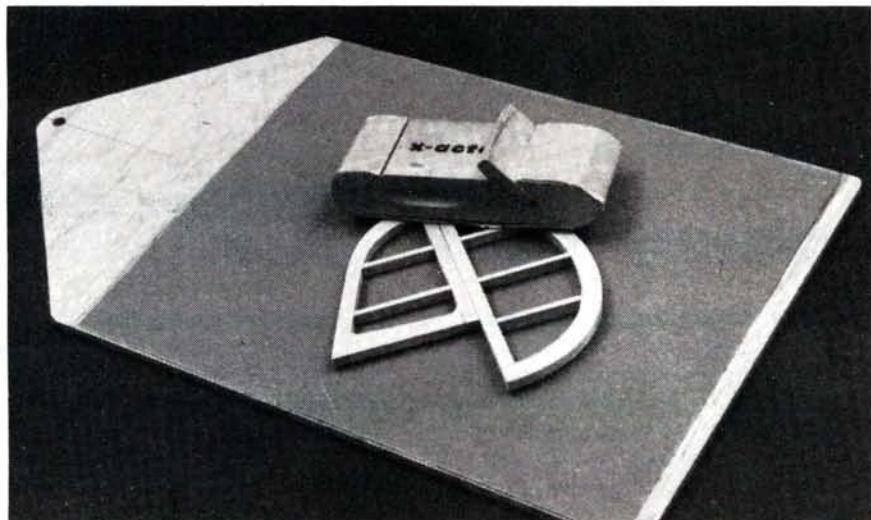
(Continued on page 75)

BUILDING MODEL AIRPLANES



JOE WAGNER

SANDING STEADY AND HANNAN'S ARCHIVES



A flat, nonskid base such as this makes accurate model-part sanding easy.

NO-SLIP SANDING

ONE OF THE most useful modeling "tools" in my workshop consists of a sheet of medium sandpaper carefully contact-cemented to a rectangle of smooth, flat plywood. No, this isn't a big sanding block—quite the opposite. I use it as a firm, slip-proof support for model components while I sand them.

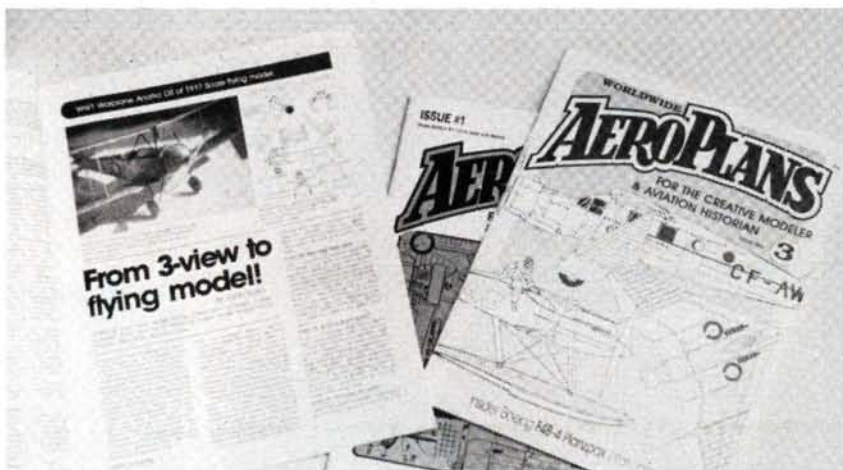
I find it far easier to do a precise job of taper-sanding an elevator or rounding the leading edge of a vertical fin when the part is held on a flat, stable base. The support works equally well for smoothing sheet balsa, like wing planking. When the object you're sanding is longer than the sandpaper-covered base, the smoothing job merely calls for shifting the wood a few inches at a time as the work progresses.

This simple "tool" can be made even more useful by gluing a straight, squared strip of hardwood an inch or so wide to the bottom of one edge. This can be used to guide a sanding block for beveling model-part edges—cowl blocks, wing dihedral joints and the like.

BOOK OF NOTE

Model airplane builders can never get enough accurate plans and data for scale models; famous and obscure designs are in demand. Drawings that show markings and

color schemes help modelers in their never-ending quest for realism. Even non-scale R/C models are often embellished with custom tail-surface shapes and scale-like insignia to provide a touch of individuality.



A.C. Anson's unusual AeroPlans books contain a wide variety of aircraft types and presentations, from old-time "10-cent" model plans to "super-scale" renditions.

AeroPlans* (three issues available so far) is a "must-have" publication for scale enthusiasts. Each contains a wide variety of airplane plans of all vintages. Some are line-work three-views (Hawker Fury, Lockheed Orion, Consolidated Fleetster,

etc.); others depict model construction (Kinner Sportster, Heath Midwing, Mohawk Pinto, Boeing F4B-4); and still others are detailed renderings of famous types such as the Curtiss Shrike, the German Albatros D-1 and the Bellanca Long-Range Racer.

My old friend Bill Hannan supplies a remarkable range of publications featuring accurate scale model airplane plans. Particularly noteworthy is the Aircraft Archive series (seven volumes in all). Three feature WW I airplanes (24 to 30 types per volume). Another three books cover WW II aircraft, primarily fighters (16 to 18 types in each). The seventh book is devoted to air racers and aerobatic planes (24 in all). Every one of the plans books I've just mentioned has at least two off-the-beaten-track airplanes in it that I've just gotta build! I don't know how Bill Hannan does it, but he keeps coming up with airplane books that stimulate my model-building appetite something fierce. Try a couple yourself, and see if the publications Hannan's

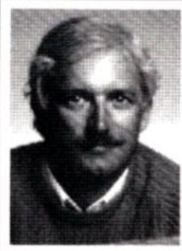
Runway* sells don't do the same for you.

**Here are the addresses of the companies mentioned in this article:*

AeroPlans, 8931 Kitty Hawk Ave., Los Angeles, CA 90045.

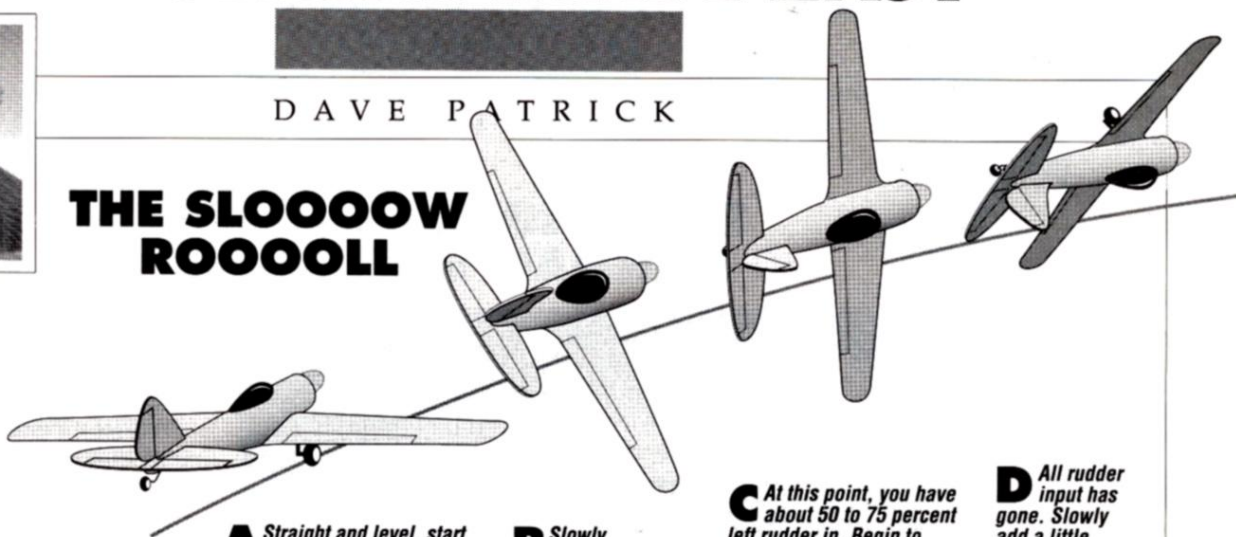
Hannan's Runway, P.O. Box 210, Magalia, CA 95954.

AEROBATICS MADE EASY



DAVE PATRICK

THE SLOOOOW ROOOOLL



A Straight and level, start to add right aileron only.

B Slowly add left rudder.

C At this point, you have about 50 to 75 percent left rudder in. Begin to remove left rudder.

D All rudder input has gone. Slowly add a little down-elevator.

LAST MONTH, we discussed the importance of rudder in aerobatics and how to avoid unwanted mixing of rudder input into aileron or elevator. Now that we've "fixed" our rudders, I'd like to walk you through your first rolling maneuvers, e.g., slow and point rolls.

When I look back on my own experi-

ence, I remember first practicing point rolls, then going on to slow rolls. Having heard that one should start with slow rolls, then go into point rolls, I realized that either would probably work quite well. In retrospect, however, I recommend that you start with slow rolls then develop your skills on the point rolls.

Before you learn any new maneuvers, you should recognize the basic components and practice by holding your transmitter and mentally reviewing what will be required for that particular maneuver. For example, for a slow roll, you should choose a direction, i.e., left or right roll. (I chose right because I felt that I might execute a

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Note: to really add polish to your slow rolls, add some up-elevator at position "B" and position "H." This will help correct for a slight heading change caused by rudder, and it will help keep the nose up. You may want to start your first slow rolls by pulling nose up slightly and "arching" the maneuver. As you become more proficient, you'll straighten the line.

E Now inverted, hold only enough down to maintain altitude. Start to remove elevator.

better maneuver against propeller torque.) Then, as you roll to the right, slowly add left rudder to hold the nose up.

As you go past 90 degrees, start to remove rudder and add down-elevator. As you approach 180 degrees, all rudder input is removed and you should just have some down-elevator. As you approach 270 degrees, start to add right rudder while you remove the down-elevator. Finally, as you finish the full roll, remove the right rudder gently so the tail doesn't "wiggle."

As you can see, a properly executed slow roll is a very complicated and difficult maneuver. After you've mentally prepared yourself by practicing a few times and you

F All elevator input has been removed. Start to add right rudder.

can fly through the maneuver completely in your mind, it's time to go to the flying field and try it out.

I believe in a "building-block" approach that utilizes steps to achieve a goal. In other words, don't try the entire slow roll at once. Build the maneuver step by step. Review sketches "A" through "I" for the nine-part breakdown of a slow roll.

The first day, you may only get to the 180-degree step. It may take a week or so to end up with some proficiency doing the full slow roll. (By the way, a slow roll should take about 5 to 6 seconds.) When you can go through the full slow roll, try it in the other direction, i.e., if you learned starting from

H Most, if not all, right rudder has been removed. Finish roll to level.

I End straight and level, on the same heading as you held at the beginning of the maneuver.

G Like position "C." Start to remove right rudder.

left to right, now practice from right to left.

When you're comfortable with slow rolls, try the point rolls. A four-point is simply a slow roll in which you hesitate every 90 degrees; an eight-point, every 45 degrees.

Wasn't that easy? Until next month....

Here's one last thing. I didn't get all the details quite right in my discussion of the FAI Championships in my April column. David Von Linsowe's plane, the USA Star (Mistriss 4), used ProPower fuel sold by Logghe Stamping Co.*

*Here's the address of the company mentioned in this article:
Logghe Stamping Co., 16711 Thirteen Mile Rd., Fraser, MI 48026.

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AIR SCOOP

CHRIS CHIANELLI



This month's "Scoop" is dedicated to two long-standing, springtime, R/C traditions—the WRAM show in White Plains, NY, and the Toy and Hobby Fair in Nuremberg, Germany. Featured here are just some of the interesting, new products for '92, proving that both sides of the Atlantic are prolifically producing hobby products!

N U R E M B E R G

High-Tech Balancing Act

It didn't surprise me that one of the most high-tech items at the show was in the Graupner booth. The mechanical man's arms are hooked up to a much-guarded box on the back of the bike. The box obviously contains an all-new leveling/gyro system. The system is so sensitive that the man and the bike stay upright to almost a full stop! The connections between the box, the arms and the handlebars were amazingly smooth, resulting in almost instantaneous movement.



One of the highlights at Nuremberg was seeing—and hearing—the German prototype FD 3-64 turbojet perform. The unit, which weighs 36 ounces and is about 5 1/2 inches in diameter, generates 7 pounds of static thrust and only 75dB at 7 meters (23.1 feet). The FD 3-64 runs on diesel or kerosene fuel and can be throttled down to an idle. For starting, the engine is spooled up using an ordinary hair dryer (heating element removed) and primed with propane. Throttle speed is controlled by an ESC-governed fuel pump. Production will start in eight to 12 months, at which time distribution announcements will be made.



FD 3-64



ROBBE CALIBRA

Frank Heinrich, general manager of Robbe's U.S. operations, holds a beautifully finished version of the high-performance Calibra. Designed for use with radios that have mixing capabilities, the model has a white Plura fuselage (the Pro version has an epoxy fuselage); skinned wing-cores; a factory-cut tail-plane mount that ensures proper incidence; and a precisely cut fuselage nose that provides proper motor-thrust settings.



DER MODEL MEISTER

Although Herr Graupner is "his eminence" in European modeling, he's also a down-to-earth modeler himself. (The photo of Herr Graupner and yours truly was taken in Graupner's gymnasium-size booth at the Nuremberg Show.) Pictured here is the new 51-inch-span Graupner Klemm 25—an all-balsa kit designed for electric

gear-reduction power. According to Dave Martin of Hobby Lobby, however, it can easily be converted to glow power. This little beauty should prove very popular in the U.S., not only because of Graupner's reputation for high-quality, well-engineered kits, but also because of the Klemm's likeness to the venerable Fairchild PT-19.



AIR SCOOP

N U R E M B E R G



ROBBE FUTURA IS HERE

It took a team of Schluter engineers two years to develop the new Futura heli. Robbe sought advice from world-class pilots to create a versatile machine that could be flown by FAI experts and novices alike. As you can see, it has straight-line linkages that run directly from the servos to the various components, and



this provides extremely positive control. The Futura also features a main rotor that you can adjust to rotate in either direction; a "toothed" belt drive that minimizes vibra-

tion; a precision mechanical mixer that makes electronic mixers unnecessary; a hexagonal tail boom for superior strength; tail-rotor constant drive; and a new, enlarged fan to cool today's high-performance engines. Further details are available from Robbe Model Sport Inc., 180 Township Line Rd., Belle Mead, NJ 08502; (908) 359-2115.

MIDDLE EASTERN MODELS

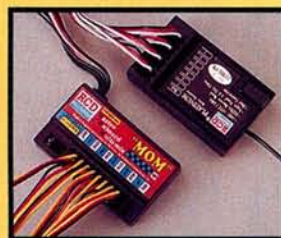


I came across an interesting, new (to me) company at the Nuremberg show—Peer Models Ltd. of Israel. They're reported to offer an extensive line of high-quality, reasonably priced balsa kits. Hobby Lobby International plans to import two models. One of them is a 63-inch-span 1915 Vicomte with a 729-square-inch wing area (perfect for a .60 to .90 4-stroke). My favorite, the Dalmatian Lady, is a 2-meter thermal or slope soarer for competition or sport flying. (Keep in mind, that's my

girl-dog Luna photographed at the flying field. Spots included with Luna only.) Watch for more kits from Peer Models, or contact Hobby Lobby International Inc., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444.



MOM'S IN CONTROL



Modern computer radios are true feats of electrical engineering but, with their many "long-stem" microswitches, they *do* resemble metal pin-cushions. Soon, courses in "transmitter braille" will be necessary for those who don't want to bump the wrong gizmo while flying a ducted-fan model at 150mph or more. RCD's new Master Onboard Multi-mix (MOM) eliminates this problem. It works with most popular AM and FM R/C systems—no special setups required. Just plug the servos into it, and then plug it into the receiver. The six mixers in each of MOM's three memories provide a total of 18 possible combinations. The unit also features direct throttle control, a battery-safety lock-out, a lost-plane finder (audio) and a transmitter-signal-loss compensator (a true fail-safe device)—all for an impressively low \$129.95! Want to know more? Get in touch with RCD at 9419 Abraham Way, Santee, CA 92071; (619) 499-1112; Fax (619) 449-1002.

W R A M

This 1/5-scale version of the beautiful Sukhoi will be available from Byron Originals in June. It has a 62-inch span, a 740-square-inch wing area and requires a .60 to .90 2-stroke or 1.20 4-stroke engine. To keep things light, the Sukhoi will feature fiberglass fuselage and a built-up wing, and its retail price will be less than \$300.



SCALED-DOWN SUKHOI

VIOLETT .91

One look at this man, and it's plain to see that he's obsessed with perfection. Bob Violet, who's famous for the high-quality, beautiful pre-fabrication in his kits, has teamed up with Henry Nelson of Nelson Competition Engines to offer ducted-fan enthusiasts maximum horse power and reliability. The BMV .91 features a one-piece case with an integral exhaust manifold, a one-piece carburetor body with a drum-rotor backplate, and a front spool for either Viojet or Dynamax fan units. Bob Violet Models claims that the .91's idle, transition and top-end power are better than those of any engine available; it will outlast them all, too! With Mr. Violet's reputation for extensive testing, this claim could prove true. Contact: Bob Violet Models, 1373 Citrus Rd., Winter Springs, FL 32708; (407) 365-4727.



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SR Batteries Inc. has used its military and aerospace experience to develop the highly sophisticated, microcomputer-controlled Smart Charger/Cycler. It can charge from two to 28 cells using peak and temperature detection. The Smart Charger monitors the batteries; if they become too hot, it shuts down. Its other features include: a digital ammeter that reads up to 250 amps; a software program that can be upgraded; reverse-polarity protection; a "smart" cooling system; an audio alert system; and computer-grade components. For fun-fly enthusiasts, SR also offers miniature flight packs that can cut onboard pack weight in half. For more information, contact SR Batteries Inc., Box 287, Bellport, NY 11713; (516) 286-0079; Fax: (516) 286-0901.



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Wing Span: 78 1/2 in. Length: 42 1/2 in.
Wing Area: 544 sq. in. Airfoil: Flat Bottom Highlift

WINDSURFER 100

Wing Span: 98 1/2 in. Length: 45 in.
Wing Area: 790 sq. in. Airfoil: Modified 205

EZ-1 GLIDERS



Wing Span: 78 1/4 in. Est. Flying Wt.: 26 ounces
Wing Area: 544 sq. in. Airfoil: Modified 205

EZ-2 "100"

A larger version of the EZ-1, easy building with turbulator spars, an open class glider that can perform with the best of them. Plug-in wings for easy transportation. Stress for high-starts.

Wing Span: 98 1/2 in. Est. Flying Wt.: 45 ounces
Wing Area: 790 sq. in. Airfoil: Modified 205

TERCEL GRENADE-LAUNCHED



Wing Span: 50 1/2 in. Flying Weight: 11 1/2 ounces
Wing Area: 275 sq. in. Airfoil: Modified 205
Length: 31 1/4 in.



FLIPPER

Wing Span: 50 1/4 in. Est. Flying Wt.: 11 1/2 ounces
Wing Area: 270 sq. in. Airfoil: Modified 205

KASTAWAY



Wing Span: 59 inches
Wing Area: 380 square inches
Est. Flying Weight: 15 ounces
Airfoil: Modified 205



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HINTS & KINKS

JIM NEWMAN



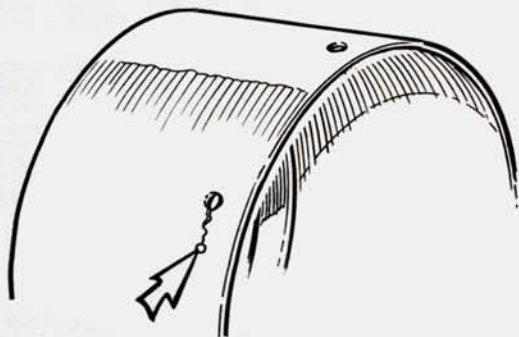
Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 251 Danbury Rd., Wilton, Ct 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



THIRD HAND FOR COVERING

A supportive "third hand" is always useful—especially when you have to cover a wing. Cover your workbench with a soft cloth to avoid damaging the wing, then stack pillows on the wing to hold it while you stretch the covering. (You could also weight down the wing with telephone directories.)

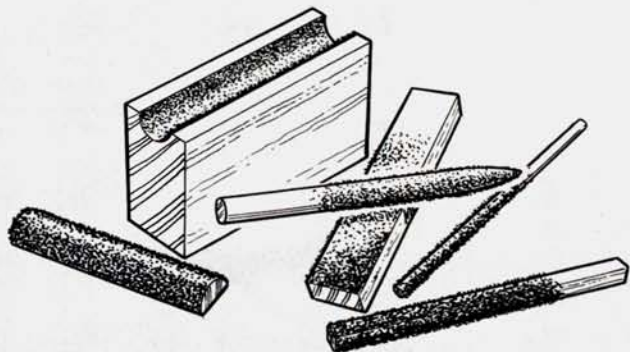
Chuck Stobaugh, Morrilton, AR



STOP CRACK SPREAD

If your plastic cowl is cracked, there's a way to prevent the crack from getting longer. "Stop-drill" a $1/16$ -inch hole right at the end of the crack. The hole will prevent the crack from lengthening until you have time to repair the cowl properly.

David Rincon, Bogota, Colombia



CUSTOM SANDING BLOCKS

Pick up a bag of inexpensive 80-grit Carborundum® from your local crafts store. Coat wooden blocks and dowels with white glue, then roll or pat them into the grit and allow the glue to dry. The shapes of the sanding blocks you make are limited only by your imagination.

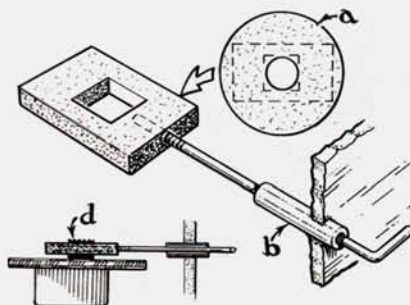
Don Olsen, Buckley, MI



TWO-LEGGED PINS

To a $1\frac{1}{2}$ -inch T-pin, solder another pin from which the head has been removed. If you make the distance between them (X) fit popular sizes of stripwood, you'll be able to use this two-legged pin to straddle the strips and hold them securely on your building board. (The pins can be pushed into Celotex® boards quite easily.)

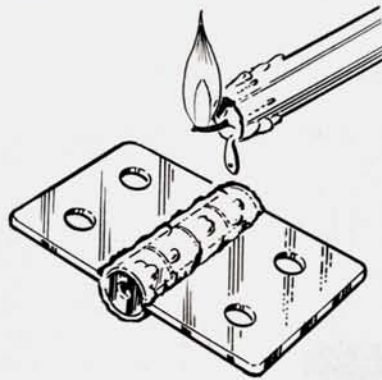
W.C. Hollingsworth, Kennett Square, PA



REMOTE SWITCH OPERATOR

Make this remote switch operator for your floatplane by cutting a thick, fiber, faucet washer (a), as shown. Make sure the square hole fits tightly around the switch knob (c). Screw the threaded wire rod into an undersize hole in the washer, and pass the other end through a piece of Nyrod or ball-point pen tube (b). To keep the assembly watertight, plug the Nyrod with petroleum jelly.

Barrie Reaby, Black Rock, Victoria, Australia



KEEPING HINGES "UNGLUED"

Keep a couple of small birthday candles in your workshop. Before you glue hinges into place (especially with epoxy), drip candle wax all over the hinge knuckle to seal it against the glue. (It's easy to scrape off the wax when the hinge has been securely glued into place.)

Chris Hamilton, Hamilton, Ontario, Canada

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of \$500, to be awarded at the end of 1992. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to:

Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.



BYRON BASHING

After he damaged his stock Byron F4U Corsair, Gene Barker of Downs, IL, made his model into this beautiful Cook Cleland F2-G racer. To modify it, he just lowered the aft turtle deck, added a Byron P-47 canopy and added the air scoop to the engine cowl. Gene says the Quadra 50-powered model has the same flying characteristics as the stock kit, but now it really turns heads at the field. We think Gene's F2-G is a fine example of the kit-bashing art.



TANK-BUSTER

Jim Wilkinson of Panama City, FL, poses with his scratch-built Ju-87B Stuka dive bomber. The 1/6-scale, 91-inch model is powered by a Super Tigre 2500 engine with a C&H electronic ignition and a homemade muffler. Jim says that the fully detailed, 20-pound model can fly and land very slowly. On landing, the front canopy opens, flaps extend 45 degrees and a microswitch turns on the landing light. Jim built the model from his own plans!

MARCHETTI MENSCHEN

This photo of an SIAI Marchetti SF 260 squadron at Löwental airport in Bodensee was submitted by Norbert and Hans Hanser of Friedrichshafen, Germany. The *Menschen* (people) are (left to right) Hans Hanser, Marc Tomaschko, Alfred Tomaschko and Norbert Hanser. The four identical, 1/5-scale models were scratch-built from original factory drawings and have fiberglass fuselages and sheeted foam wings. Each plane spans 65 3/4 inches, weighs 11 pounds and is powered by a Moki 25ccm (1.52c.i.). If the formation flies as well as it looks, these German *Piloten* (pilots) should be proud.



PILOT PROJECTS



WACO UNDER THE INFLUENCE

Is the pilot of this plane drinking? Last year, Captain Ulrich V. Hanus re-discovered his love of modeling and built this Pica Waco YMF-3, which is powered by an O.S. .91 4-stroke and finished with Randolph dope and litho aluminum. It's a good thing Hanus doesn't take after his Waco pilot, because he loves aviation so much that he flies Boeing 737s for a living!



TWO OLD-TIMERS

From Ranier, OR, come 73-year-old Martin L. Johanson and his 29.5-inch-span, true-to-scale Fokker D-7. Mr. Johanson writes: "Having been born in 1918, I grew up with those old crates." Mr. Johanson builds from scale drawings, and he's currently working on a 30-inch wingspan SPAD-13.

ALBUQUERQUE ALERT

On watch in the Southwest are Greg Anixter and Jim Daniels' Violet Aggressors preparing to scramble in defense of the New Mexico skies. According to Greg (builder of the desert-scheme version), even at the 5,500-foot altitude, the performance of both models (one with a BVM .82 and the other with a KBV .72) is outstanding. The guys love putting on shows with their Aggressors; the latest was a benefit for the "Toys for Tots" program in their area.



by
AL
MASTERS



3RD
PLACE
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Dornier-335

TANDEM

IT WAS IN May '62, as I perused a pile of aviation magazines, that I read about a little-known WW II German aircraft. The article described a unique twin-engine aircraft with engines mounted in a push/pull configuration; it was reportedly the fastest propeller-driven aircraft developed during the war. The war ended before the many versions of this spectacular fighter/bomber could be made operational. It was the Dornier-335 Arrow.

ENGINE

What an R/C scale model it would make! I addressed a letter to Dornier-Werke in Friedrichshafen, Germany, requesting scale draw-

ings and information that would enable me to design an R/C scale model of the Do-335. In hopes that my inquiry would cross the desk of a sympathetic reader, or even a fellow modeler, I enclosed pictures of my French Caudron C460 Racer. (The 1/4-scale Caudron weighed 8 1/2 pounds, carried an Orbit 10 radio and had picked up trophies in national competition.) It was like fishing—nothing to do but wait!



With both engines singing and the gear neatly lucked into place, the Arrow streaks by.

It was an exciting moment when, after after three long weeks, I received a large envelope from Germany! Inside were scale three-view drawings, fuselage sections, air-

foils and data on wing washout. To top it off, black and white photos of the Do-335 were included. Bingo!

The photos were of the "V3," the third prototype aircraft, which was devoid of the armament and landing lights that were included on later versions. A close study of the photos with a magnifying glass revealed that the swastikas had been removed by postwar German censors.

Powered by two K&B* 45s and sporting handmade electric retracts, my 70-inch, 1/8-scale Do-335 flew that year. Since I built that model,



Test pilot Ray Doan (holding the transmitter) and I pose with the Dornier-335 after another successful flying session.

PHOTOS BY AL MASTERS

"ARROW"

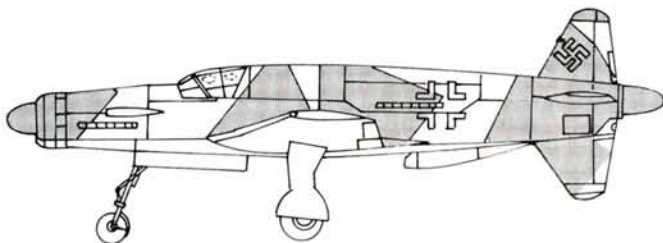
The model requires some degree of construction expertise, but it has been designed for builder/fliers who would like to scratch-build a unique, twin-engine scale model that doesn't have the inherent problems associated with twins.

excellent, scale, three-view drawings have been published, as have detailed booklets covering the many modifications of the full-scale aircraft. (For those who are interested, documentation sources are listed at the end of this article.)

The abundant fin and rudder area provides excellent rudder response, but the cuneiform tail section does have some negative attributes! The full-scale Do-335 was equipped with a rugged, hydraulic, shock-absorbing tail-bumper system, and the whole lower fin and rudder could be jettisoned with explosive bolts if a gear-up landing was anticipated. Should the pilot elect to eject, explosive bolts could also be called upon to separate the aft propeller from the airplane, thereby saving the pilot from passing through the propeller.

As of this writing, I've built and flown four 1/10-scale renditions. We were putting model number three through "gear-down" flight tests when it had a midair! Tom Krasin's Corostar-40 came in at two o'clock and passed under the Dornier, ripping off its main gear

units and much of its lower wing skin. The Corostar spun in. The 335, with both engines still operating, was 12 ounces lighter and still flying! Ray Doan, who was piloting the 335, commented that



the plane had become a "floater" as he made a "nose-wheel-only" runway landing! (The landing cleaned off the lower fin!) A team search of the field adjacent to the runway recovered both Spring Air* main gear units, which had fallen free after impact.

The model requires some degree of construction expertise, but it has been designed for builder/fliers who would like to scratch-build a unique, twin-engine scale model that doesn't have the inherent problems associated with twins. An additional benefit is that you can fit this 56-inch-span model into a medium-size station wagon without having to dismantle it!

CONSTRUCTION

Study both plan sheets and note that the bulkheads and ribs have been arranged near the sheet edges to make tracing them onto templates or construction material easy. Weight-saving construction aft of the center of gravity (CG) is of major importance when building this model. Use light 4- to 6-

pound balsa throughout; only the main wing spars are of medium-hard balsa. Lightening holes should be made where shown. The plans also include some building suggestions, but experienced builders may want to use their own methods.

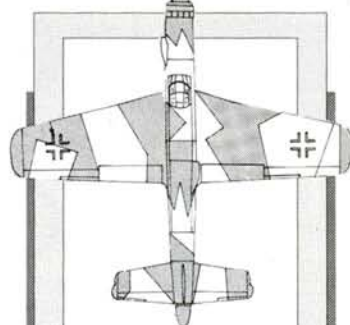
This 1/10-scale model was designed and flight-tested using two engines of equal size so that the plane would stay airborne if either engine failed. You'll need nose ballast, so always pick the heaviest engine for the tractor spot to reduce ballast requirements. The scale high thrust line in front will allow some engines to be inverted inside the cowl. A 40-size engine up front will add no additional weight. My four models use O.S.* Max 25FP engines. The available space for the 6-ounce fuel tank is fixed by design and must be taken into consideration if a

larger fuel-burner is placed up front!

I installed standard Spring Air retracts on all my models, and I used the heavy-duty unit for the shock-mounted nose wheel.

FUSELAGE

Trace and cut out the parts. Bulkhead halves can be nested to save material. One-



DORNIER-335 (V3)

TYPE:

Scale Twin WWII German Fighter

SCALE:

1/10

WINGSPAN:

56 inches

LENGTH:

56 inches

WING AREA:

600 square inches

POWER:

O.S. Max 25 (2)

FUEL CAPACITY:

12 ounces
(2 6-ounce tanks)

GROSS WEIGHT:

8.75 pounds

WING LOADING:

33.6 ounces per square foot

RADIO:

5 to 6 channels (rudder, elevators, ailerons, throttles, retracts, optional flaps).

CONSTRUCTION:

built-up wood



In 1962, I received photos of the third prototype aircraft (V3). Postwar censors eliminated the swastikas.



piece bulkheads are less work, but they result in considerable material waste. The bulkheads are rather flimsy to work with, but the final structure will prove quite rugged. The plywood parts are one-piece and cut apart where indicated. Make fuselage part F10 and wing part W1 at the same time, and match-drill the holes for the two 1/4-inch wing dowels in them.

Pin the crutch over the wax-paper-protected plan, and glue the aft fuel-tank support in place. Epoxy F20 to the aft tank support and epoxy the two 1/16-inch ply braces in place. Proceed with the

DORNIER 335

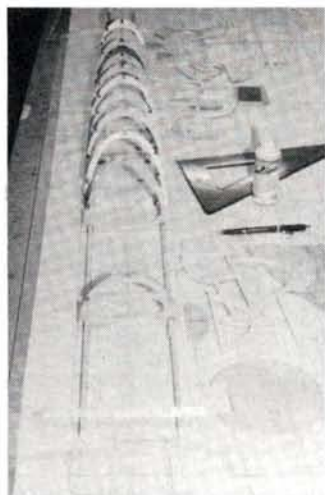
bulkhead placement, taking care to insert scraps of $\frac{1}{16}$ -inch balsa in the crutch area to provide the slot for inserting the $\frac{1}{16}$ -inch ply wing saddle beam later. Avoid gluing the small scraps to the crutch and the bulkheads because the scraps must be removed later.

Fit the backbone and the stringers to give the assembly rigidity, and add the top sheeting from F9 to F19. When you add the sheeting to the top of the fuselage, soak sections of sheeting in an ammonia-and-water solution, and bend them over the backbone, but don't glue them! Hold each piece in place with masking tape, and when it has dried, trim it and glue in place. This method will result in a very nice fuselage line without the usual sanding problem in this area. Don't remove the structure from the building board yet!

CANOPY

The canopy can be framed up while the upper fuselage is still on the crutch. Cut the plywood frames and use wax-paper glue barriers as you clamp F4C to F4 and the $\frac{3}{32}$ -inch ply rear canopy frame to F9. Wax paper should also be placed under the two $\frac{3}{16} \times \frac{1}{2}$ -inch balsa canopy-base pieces. Canopy frames are cut out of $\frac{3}{32}$ -inch ply and tack-glued with CA. Reglue with epoxy when the frame-up looks right. Provide for the canopy hold-downs. Attach $\frac{3}{32}$ -inch pre-formed sheet balsa to the front of the canopy, and remove the unit from the fuselage.

If desired, canopy blisters can be made. Cut a teardrop-shape hole in the center of a piece of $\frac{1}{4} \times 8$ -inch-square plywood. Take a piece of



Protect the plan with wax paper, and begin by gluing upper bulkheads to the crutch.

.015-inch-thick butyrate sheet that's 5 inches square, and center it over the cutout. With masking tape, tape all four edges down. Heat the butyrate in an oven or with a heat gun until it sags, and force a teardrop-shape wooden plug into the butyrate and through the cutout. A vacuum cleaner can also be used to draw the soft butyrate through the cutout. Make the two side pieces with the blisters that allow space for the rearview mirrors.

Silver MonoKote* can be used for the mirrors; they add a nice scale touch! Paint the ply frames (color 82), before attaching the butyrate sections with RC-56 glue. I placed pre-

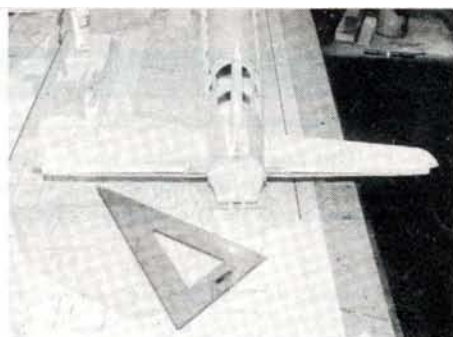
painted automotive striping tape (color 82) over the seams.

TAIL GROUP

While the upper fuselage is still on the building board, make the stabilizer and upper fin of light $\frac{1}{4}$ -inch balsa sheet. Fit 19A, 19B, 19R and S1 to the stabilizer and upper fin. Use wax paper as a glue barrier as you construct the removable tail section in place. Trim the pre-formed $\frac{3}{32}$ -inch balsa sheet to fit over 19A and 19R, and allow it to overhang F20. Remove the tail unit and inlay the two $\frac{1}{8}$ -inch ply pieces, assembled with the 4-40 blind nuts, so that they're almost flush with the underside of the stab. The two $\frac{3}{32}$ -inch ply mating fuselage pieces will be epoxied in place later after careful fitting to the fuselage. Epoxy the pre-drilled $\frac{1}{8}$ -inch ply torque-rod bearing to F20.

RETURN TO THE FUSELAGE

Remove the upper fuselage from the building board, and fit the two wing-saddle beams in the

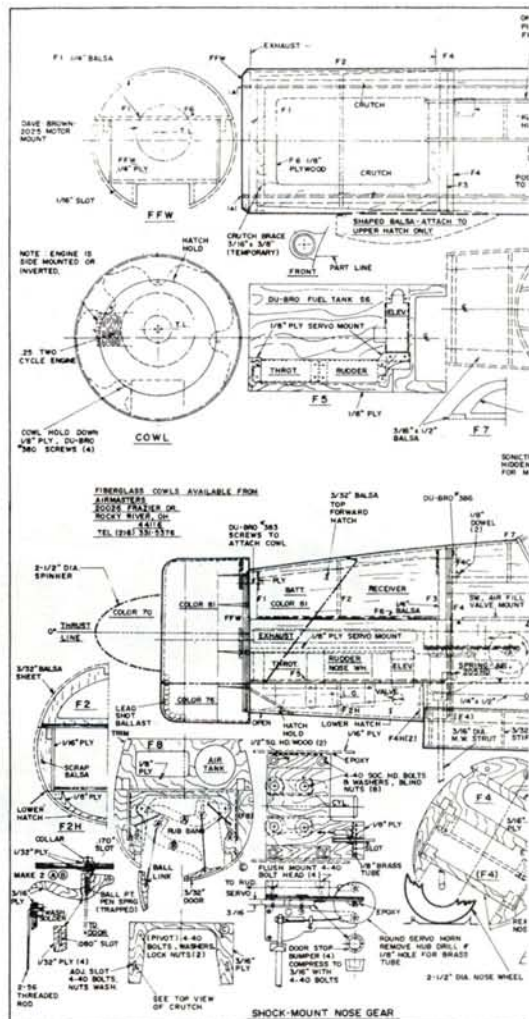


The removable tail section is constructed in place over the crutch. (For ease of construction, the empennage on my fourth model was changed to lightweight $\frac{1}{4}$ -inch balsa sheet.)

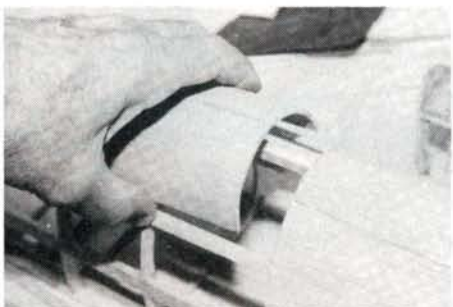
slots and alongside the crutch. Clamp and glue. Make up the front firewall (FFW), including the blind nuts for the motor mount. Fit FFW over the $\frac{1}{16}$ -inch ply beams, and make sure the assembly is at a right angle to the crutch. Epoxy the firewall in place. Glue in the lower bulkhead sections and add the aft stringers.

Lay out F5 and make cutouts to accept the servos to be used. Epoxy F5 in place. The servos are mounted on $\frac{1}{8}$ -inch ply (with supports), which is epoxied in place above F5.

The wing-saddle area and fillets are completed after the wing has been trial-fitted to the fuselage.



Aft tank support and the two-ply braces have been epoxied in place over the crutch. Use epoxy sparingly in the aft section to avoid excess weight.



Pre-formed $\frac{3}{32}$ -inch balsa sheet is added over the backbone before removing the structure from the building board.

DORNIER 335

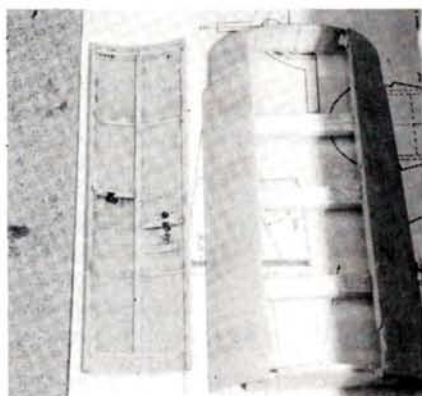
protective film and proceed. Secure half the lower spar to the plan with pins or weights, and support the other half to hold it off the building board. Position the ribs on the spar, cutting each rib off to make the flap or aileron rib as you go. Rib 1 is slanted from perpendicular. When setting ribs 6, 7, 8 and 9, provide for the tip washout by supporting rib 9 as indicated on the plan.

Add the tapered aileron sub-spar and sub-leading edge. The $\frac{3}{16} \times \frac{1}{4}$ -inch spars can be slipped into place. Add the $\frac{1}{8}$ -inch sheet-balsa tips and tip frames. The $\frac{1}{4}$ -inch-square medium-hard balsa upper spar is placed, and any missed joints get a final shot of CA.

Remove the panel from the building board, and proceed with the other half of the wing in the same manner. W3 is now glued in place to support the aft center section, and rib parts 1A (a doubler) and 1B (a center-section filler rib) are added behind W3. W1 is fitted in place and tri-stock supports are added. Shear webbing is now added out to rib 6.

The upper wing skins are made of lightly sanded $\frac{1}{16}$ -inch sheet balsa. Attach the two upper skins, adding the filler support at the center section. The wing can now be completed by working from the underside. Add bellcranks, control rods, retract mounts, air lines, aileron hinge supports, etc. Add the bottom wing skin, but don't open the wheel wells.

The fiberglass main-gear doors are made up before the wheel-well/strut openings are cut through the lower wing skins. Use masking



The nose wheel door frame is made with temporary cross-braces and pre-formed $\frac{3}{32}$ -inch sheet balsa. The nose-wheel doors were made as one piece, then sawed apart.

tape around its outside edges to put a piece of MonoKote over one lower wing panel. There's no need to remove the plastic backing on the MonoKote. Proceed to lay up 6-ounce glass-cloth/resin over the MonoKote for an area large enough to overlap the wheel/strut cover. When the cloth/resin has cured, it can be peeled off (the MonoKote acts as a parting agent). The MonoKote can be used on the other wing panel.

Trace and cut out the gear/strut covers. The wheel and strut wells are now open, and the fiberglass wheel covers will fit nicely to the wing contour.

Where the wing trailing edge fits the fuselage is a section that will have to be completed by fitting the wing to the fuselage and blending the formers and sheet balsa for a satisfactory fit.

Open the access holes to install the flap hinges. The $\frac{3}{4}$ -inch balsa tri-stock leading edge and stall-breaker inboard leading edge are added, shaped and sanded to blend with the wing skins.

Flaps and ailerons are trial-fitted but not attached until after painting.

FINAL ASSEMBLY/FINISHING

Apply $\frac{3}{4}$ -ounce (or lighter) glass cloth/resin or your preferred paintable covering material. Mask off and spray the camouflage pattern. Rudders, elevators, ailerons, flaps and gear doors are all painted before assembly.

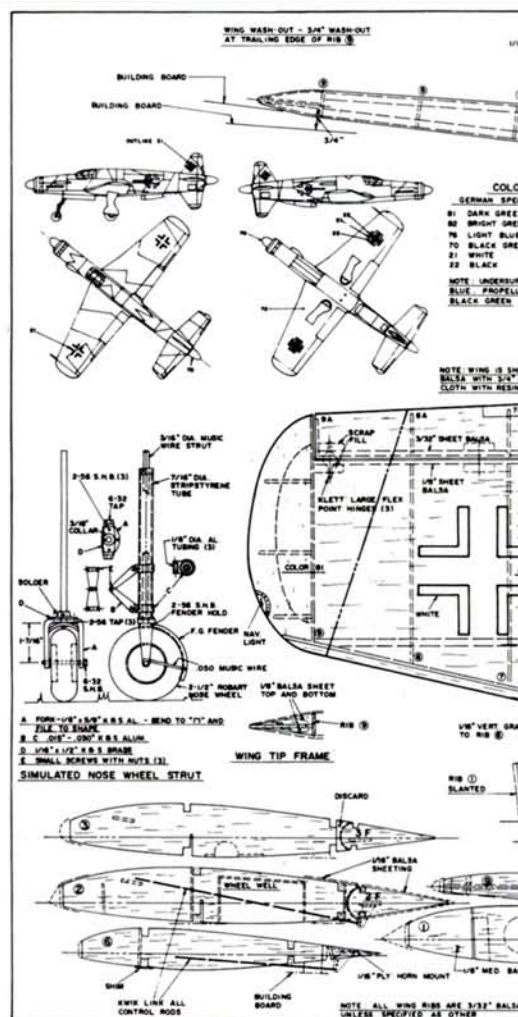
Add details, i.e., exhausts, carb intakes, numerals and insignias. A marking pen can be used for panel lines. Coat the whole model with flat clear to enhance the colors.

FLYING

The pusher propeller should be the lightweight Zinger* 9x6 in conjunction with a standard Carl Goldberg Models* spinner. (The plans show a scale, longer spinner that can be made of foam for static display.)

Attach a heavier Master Airscrew* 9x6, a Higley Heavy Hub and a standard Carl Goldberg spinner to the tractor engine.

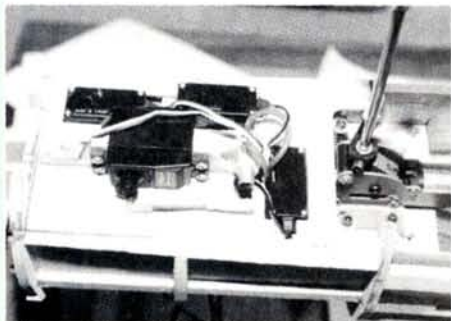
Add shot ballast to the inside of the front cowl to establish the correct CG without fuel.



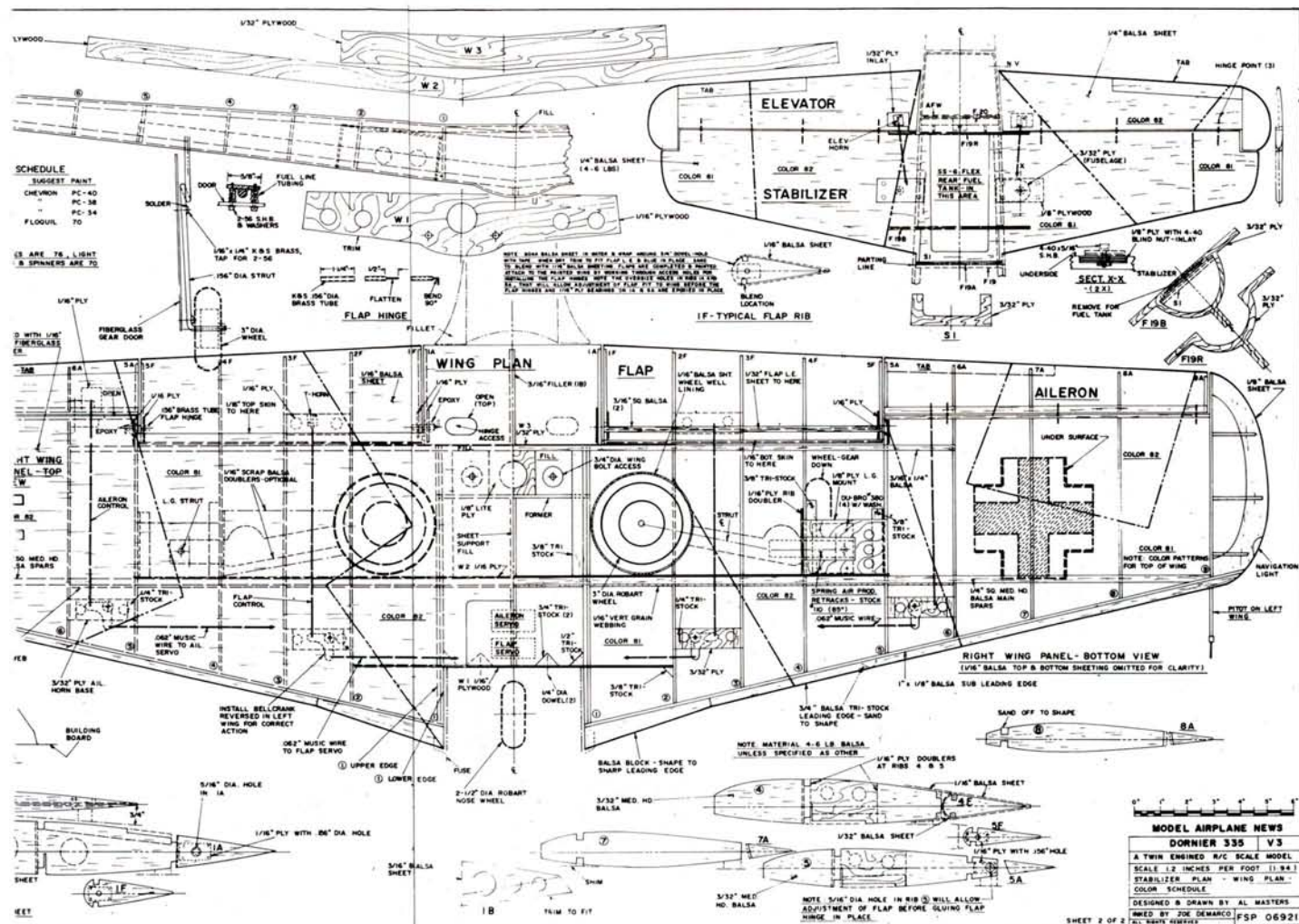
Fiberglass cloth ($\frac{1}{4}$ -ounce or lighter) being applied to the fuselage.

The aft fuel tank is piped up with the clunk forward. Always start the aft engine first to start the fuel burn-off in the aft tank, thereby allowing the CG to creep forward. With both engines at full bore, the two 25s put out the equivalent thrust of a 60. (Records show that the full-scale Do-335 had a higher single-engine speed when the front engine was shut down.) When checking the aft engine at full throttle for fuel draw, remember to hold the nose of the ship down, not up! It's wise to top off the fuel tanks if extensive run-ups have been made during the initial needle-valve tweaking!

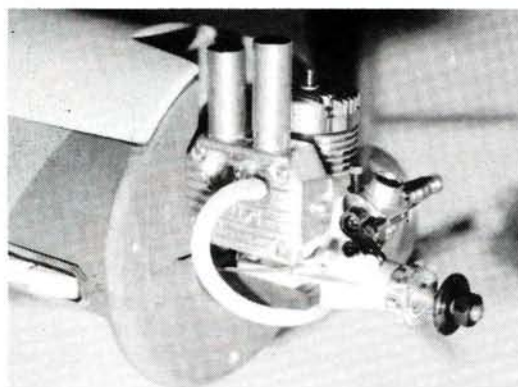
The long tricycle gear has considerable drag,



The lower front hatch hides the retract servo and valve. The underside of F5 is shown with the three servo cutouts.



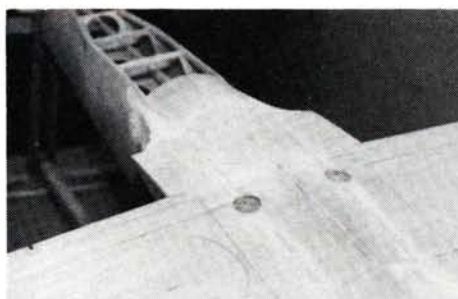
Camouflage paints are specified. The fuselage and upper front hatch have been masked off and are ready for color no. 81.



An inverted O.S.25FP fitted with a J'Tec manifold has been mounted in the tractor position.

so retract it as soon as possible after takeoff. If the aft engine stops early in the flight, land the plane as soon as possible. If fuel isn't being burned in the aft tank, the CG will shift to the rear as the front tank gets lighter!

With both engines singing, the ship will put on a most spec-



The wing is fitted to the fuselage, and the underside center section of the wing is sheeted with ³/₃₂-inch balsa sheet, which is blended with the fuselage. Wheel wells are opened after the fiberglass well covers have been made.

tacular show, especially when the crowd calls for a low flyby. With its cuneiform tail section, it truly appears to be an "arrow" as it streaks by. If the pilot gets carried away with the thrill of it all and lets a tank run dry, there's no need for the frantic trim requirements that are usually associated with an

engine-out situation on a conventional multi-engine plane. Happy flying!

*Here are the addresses of the companies mentioned in this article:

K&B Mfg., 12152 Woodruff Ave., Downey, CA 90241.
Spring Air Products, 82 Parkhill Blvd., W. Melbourne, FL 32901.

O.S.; distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.

MonoKote; distributed by Great Planes Model Distributors.

Zinger; distributed by J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.

Carl Goldberg Models Inc., 4734 W. Chicago Ave., Chicago, IL 60651.

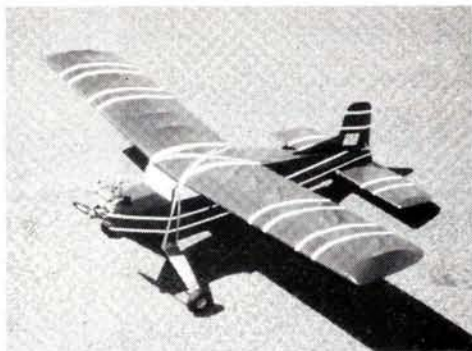
Master Airscrew; distributed by Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742. ■

DOCUMENTATION SOURCES.
DORNIER-335

Schiffer Publishing Ltd.
1469 Morstein Rd.
West Chester, PA 19380

Monogram Aviation
Publications
P.O. Box 223
Sturbridge, MA 01566

Scale Model Research
2334 Ticonderoga Way
Costa Mesa, CA 92626



Gray Budelman's outstanding Live Wire Trainer—a deBolt design. He won the "most flights" award more for attempts than actual flights (he was surely tenacious). Airplane is covered with MonoKote, powered by an Enya .15 and controlled by a JR radio.

the Way We Were

by ART SCHROEDER

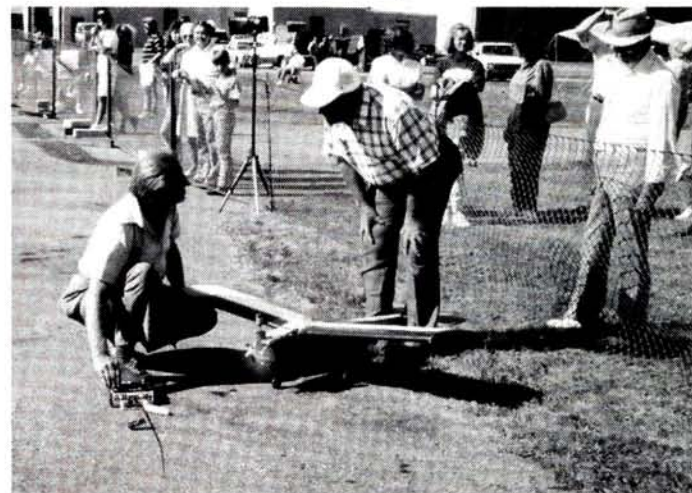
SELINGSGROVE, PA, was an annual meeting place for many R/C modelers in the '50s. It was "the" place to show off new equipment or aircraft and a place to learn more about the mysteries of controlled flight. As such, it became a "mecca" for radio control. The Vintage R/C Society has recreated that scene by filling the Pennsylvania sky with "ancient" aircraft designs at its second annual reunion. T'was a weekend filled with memories!

TWO YEARS AGO, the Vintage Radio Control Society (VR/CS) became part of the aeromodeling scene. The Society, originally proposed by Bill Winters and Hal deBolt, became a viable organization when John Worth, former AMA Executive Director, took the idea and developed it. Its main purpose was to preserve airplane designs used in the early days of radio control by building, flying and enjoying those marvelous creations. This, of course, sounds much like SAM (Society of Antique Modelers), but it has a significant twist. While SAM's main interest is in old-time, duration, free-flight, VR/CS has a

passion for R/C models designed to duplicate full-scale maneuvers.

The first annual Selingsgrove Reunion held in 1990 proved to be a huge success—so much so, that the organization returned in '91 on the Labor Day weekend. The site was the Penn Valley Airport—the place where Walt Good, Hal deBolt, Howard McEntee, Maynard Hill, Al Diem, Fran McElwee, John Worth and so many other radio pioneers unveiled their latest efforts in the '50s.

Rules for the VR/CS are simple: any aircraft is acceptable at VR/CS events as long as it was designed (published and/or kitted) and flown with R/C before December 31, 1963. This cov-



Above: Rich Tanis readies his Miss Fortune under the watchful eye of Fran McElwee. There are many, many years of R/C experience in this duet. Below left: Tom Ailes came with an enlarged version of the famed U-control Jim Walker Fireball. Fine flying R/C airplane, but prone to all kinds of unintended maneuvers on the ground. Magnum 44 power.

ers the most interesting designs ever developed for model flight, including a number of free-flights converted to R/C in the early days. The format is basically a fun fly, but a simple, low-pressure competition was included (more on this later).

For the record, nearly 40 of the faithful showed up with over 60 airplanes that included the Live Wire Champ, Cruiser and Trainer (all deBolt designs), Rudderbug, Robot, Taurus, Esquire, Multi-Bug, Aero 15, Propo Cat, Astro Hog (the only eligible design still in current production—by Sig), Viscount, Peashooter, Charger, Big Pappy, Beam, Rebel, Miss Fortune X, Mac 17 and others. It appeared that the Live Wire Trainer was most popular, with no less than six on the flight line.

Perhaps the most interesting airplane was flown by Bob Kopski (Mr. Electric for Model Aviation). This was a Galloping Ghost-equipped Esquire on electric power.



• • •
**A FLIGHT
DOWN
MEMORY
LANE**
• • •

the Way We Were

For those who don't know what the Galloping Ghost is, it's a '50s control system in which one actuator controls both rudder and elevator. The system is a pulsing system that senses signal on/off percentages and causes the rudder to swing either right or left. At the same time, pulse rate can be slowed or increased, and this can be translated to elevator control. The surfaces are constantly "dithering," with the airplane following the average position for pitch and yaw (which causes the airplane to "twitch a bit"—or "gallop"—as it flies; hence the name). Back in the early days, the system provided dual proportional control very effectively and at very low cost.

That Kopski accomplished this with modern equipment, with no changes to the equipment itself, is so remarkable that the Society awarded him its achievement award for 1991. Bob did this with what he calls "re-encoder" that plugs into a regular receiver. This converts the receiver outputs into width and rate usable by the old Mighty Midget motor/actuator that actually drives the surfaces.

His airplane, the Esquire, is an old Midwest kit. It's a high-wing trainer type that's as fine a flier as any trainer available today. In radio's early days, we knew we had



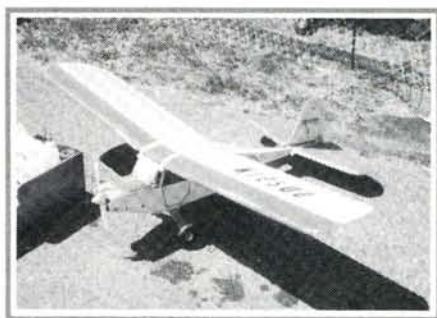
The long and short of it. Lou Andrews' legendary Aeromaster has been enlarged and reduced by Tony Wilford. The big one uses O.S. 300 power, and the tiny one has a G-Mark .10 twin engine. Wilford put on a spectacular performance with the giant. The normal-size Aeromaster is still available in a .60-powered kit from Great Planes.

excellent, stable aircraft designs. But, much of the time, the very unreliable radio link wouldn't allow us to demonstrate a design's full capability. With modern equipment, the old ships really come alive. One could do far worse scratching out some of the '50s airframes; many are superior to 1990's designs.

This was amply demonstrated by Fred Peters with his Aero 15—a John Zaic design. Peters literally flew from morning to night for the reunion's scheduled three days; and rarely did he get more than 500 feet from his transmitter. The aircraft wasn't particularly fast, but it was super-maneuverable, very light and nearly ideal for small-field flying, despite its O.S. .264-stroke power. Fred surely extracted maximum performance from the simple design.

On the other side of the coin came Weldon Smith with his original delta design—Talon Zephyr. The O.S. .15-powered "diaper" was mighty fast and roared through the 1959 pattern as if on rails. Weldon was one of the original pioneers in delta design, with the Talon series originally designed for an early AMA open pylon event.

Ed Kazmirski's well-known Taurus was flown by Cosmo Petrone in both the fun fly and competition. The airplane has very rakish lines and would be in keeping with anything on today's flight line. The thick-wing bird proved as fine a flier as it did back in its '60s heyday.



Bud Schenck's incredible Live Wire Champion has flown over 300 hours. Built from the original kit in the '50s, the aging bird uses a Fox ukie engine.

How to Get Started

The flying of vintage radio-control airplanes is a growing facet of the hobby that's fascinating and fun. It's also very rewarding since the airplanes of the vintage era (those to 1963) are among the finest flying models ever designed. Unfortunately, these airplanes are no longer available in kit form so, to fly one, you must enter the realm of scratch-building. This is much easier to do than most think: buy a plan, secure all necessary materials and cut a kit. The biggest problem with

scratch-building is getting started. The only difference is that one makes one's own kit, but it isn't at all difficult if you have X-Acto knives and some kind of scroll saw, manual or power.

The steps to enter VR/SC activities:

1. Join the organization by sending \$15 to Joe Beshar, Secretary/Treasurer VR/CS, 198 Merritt Dr., Oradell, NJ 07649.
2. Buy a plan from the many available sources:
 - Model Airplane News Plans Service,

- 251 Danbury Rd., Wilton, CT 06897.
- John Pond, 253 No. 4th St., Box 90310, San Jose, CA 95109.
- Norm Rosenstock, 124 Granada St., Royal Palm, FL 33411 (25 percent enlarged Live Wire Trainer and Winter's Rookie are available).
- Fran Ptaszkiewicz, 23 Marlee Dr., Tonawanda, NY 14150 (original and reproduced deBolt Model Engineering plans).
- W.E. Technical Services, P.O. Box 76884, Atlanta, GA 30328.
- Tom Dixon, Suite 401, 1938 Peachtree

- Rd., Atlanta, GA 30309.
- Alan Walker, 5 Farm Close, Belper, Derbyshire, DE5 1RY, England.
- Gleeson Ent., 1106 10th Dr. SE, Austin, MN 55912. (Most of these have listings of their available plans, so contact them for prices.)
- 3. Purchase your materials. The local hobby shop is the best source, but failing that, *Model Airplane News'* pages are filled with sources.
- 4. Then, build, build, build!



Leon Shulman's fantastic enlargement of a 1947 ukie—the Secret Weapon. Now under R/C, the machine can "outfly" most designs of the '90s. ST 3000 power.

the Way We Were

George Plumer flew a Bud Atkinson-designed Propo-Cat that was a shoulder-wing design with Super Tigre power and topnotch performance. Many would look at it and feel the aircraft was more trainer-like than performance oriented; they'd be wrong! This rudder/elevator design produces some of the finest looping maneuvers I've ever seen and, despite its rudder control, it can deliver very axial rolls. That makes it a standout even today.

Still flying on 27MHz (he has never stopped), Fran McElwee brought his original Robot—a very attractive high-wing airplane with super performance. The wing has a semisymmetrical airfoil and is as capable inverted as upright. Power was an Enya 35 with a Kraft transmitter, Heathkit receiver and servos.

A really neat airplane from *Model Airplane News* in 1936 was the GHQ Sportster. This shoulder-winger sported a cockpit and featured beautiful construction by Bill McKee. The real "old-timer" used a K&B .45 and Futaba equipment. It's strange how something this old can have a look so different that it's hard to place it in an era; truly, a different project.

"One of the most challenging aspects—and one rarely seen today—in radio control is the flying of models on rudder-only control. This is the way we did it in the beginning. It will surprise many that several maneuvers, even those that usually require elevator control, can be flown with just rudder."



The GHQ Sportster by Bill McKee. This old-time design is from the pages of *Model Airplane News* in 1936.

Back in the '50s, Bud Schenck (one of the originators of the first Selinsgrove get-together) built a deBolt Champ. It's a nice-looking, semi-scale rendition of the Aeronca Champion. The model should be kitted by someone today, since there's nothing in the trainer and intermediate class that can approach the stability, maneuverability and

reliability of this great airplane. The airplane, powered by a 1952 Fox 35 ukie engine, lives today and still goes airborne with its original engine. No "hangar queen," this one. Bud has amassed 339 hours and 15 minutes on the Champ over the years and is continuing to the 500-hour level. I think this may be a candidate for the Guinness Book of Records.

The Secret Weapon, which was originally designed in 1947 as a control-line kit and produced by Leon Shulman's company at this time, was popular. I suspect it could be even more popular in Leon's latest version. This sleek bird, scaled up two times to a wingspan of 80 inches, now sports an ST 3000 engine. To say that its performance is sensational would be understating the case; this one was the hottest performer at Selinsgrove. Makes one wonder what some of the other great looking ukiies would do on radio.

For at least one design that once ran around in circles, we didn't have to wait long for an answer. Tom Ailes showed up with a "2x" enlargement of the famed Jim Walker Fireball. In the air, the airplane was a snappy performer, but it was also a handful on the ground because of poor landing-gear position for our type of flying. Tom indicated the airplane was easy to make take off from grass, but a tiger on Selinsgrove's hard runways. The airplane was powered by a Magnum 44.

One of the most challenging aspects—and one rarely seen today—in radio control is the flying of models on rudder-only control. This is the way we did it in the beginning. It will surprise many that several maneuvers, even those that usually require elevator control, can be flown with just rudder. For example: with a properly trimmed airplane, a two-turn spiral dive or split-S (trade altitude for air speed) will net enough speed on recovery to carry the airframe through a series of loops. Recovery is accomplished by low throttle and a wide turn away from the maneuver.

In any event, John Harrison flew a Guillow Charger rudder only and demonstrated a feel for rudder flying that was equal to the best in the

'50s. John is a relative newcomer to R/Cing and totally enjoys baffling his flying buddies with what seems to be impossible. Give it a try; you may be surprised.

All the airplanes did well under modern guidance and provided the many spectators with a history lesson and the modelers with a giant serving of nostalgia. Indeed, one *can* go home again; VR/CS proves it!

The competition included three events flown under the 1959 AMA rules for radio-control stunts: Class I (Jack Port memorial, for rudder only); Class II (Howard McEntee Memorial, for rudder/elevator) and Class III (Ralph Brooke Memorial, for rudder/elevator and aileron). All three classes used motor control. The pattern was flown informally before two judges whenever an entrant called for judging. Many didn't participate, but many did and with these results: Class I: John Harrison (Guillow Charger), 132 pts.; John Stare (Guillow Charger), 119 pts.; Tom Ailes (Midwest Esquire), 45 pts.; Class II: John Stare (Mac 17), 174.5 pts.; Charlie Yaindl (Walt Good Rudderbug), 102.5 pts.; Tom Ailes (Vanguard), 70 pts.; Class III: Weldon Smith (Talon Zephyr), 228.5 pts.; Cosmo Petrone (Top Flite Taurus), 191.5 pts.; Tom Ailes, 90 pts. (Tom brought a fleet of six or so airplanes and used his R/C Fireball for this class and his three third places were a model of consistency).

Everyone agreed that this kind of competition without the dog-eat-dog quality or pressure was a lot of fun. VR/CS intends to keep it that way.

A great time was had by all, and the VR/CS intends to do this again next Labor Day weekend. A huge thank you is extended to the management of the Penn Valley airport and the members of the host club, the Susquehanna Valley R/C Club. You can join in the fun by joining the VR/CS (contact Joe Beshar, Secretary/Treasurer, 198 Merritt Dr., Oradell, NJ 07649; dues are \$15 and include the Society's bi-monthly newsletter) and building a pre-1963 airplane. Those of us at Selinsgrove are sure you'll be happy with that project, and we'll be happy to see you at our next reunion. ■

GOLDEN AGE OF R/C



HAL DeBOLT

GALLOPING GHOSTS AND PULSED PROPO

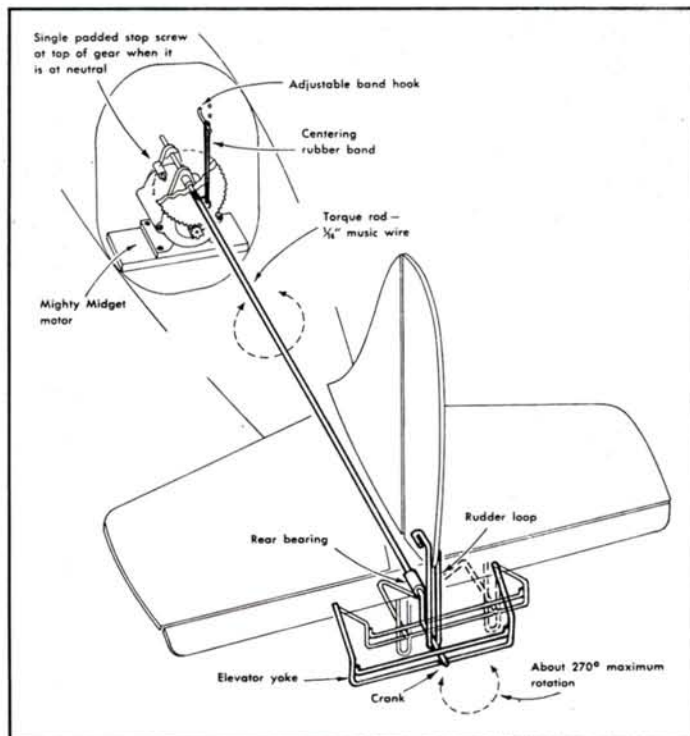
MOST R/CERS today take for granted how their R/C systems operate; 'twasn't always so! Basic full-scale aircraft are flown in the same way: as you move the control stick or wheel, the control surface follows the movement exactly. We call it "proportional control"; full-scale pilots say they "feel" what's happening, and that's about the only difference. The exotic jets use a system much closer to ours. Their control surfaces are also operated by proportional servos; their control is basically a transmitter also. The difference is that their "transmitter" is connected to what would be our airborne system by wires instead of radio waves. So it's said they "fly by wire," where we fly by radio.

Early R/Cers with their "bang-bang" control operation recognized the value of flying à la full scale. It was a great desire that persisted from the first single channel on through the "reed days," with everyone looking for a way to get a proportional effect. *Pulse* became the key word. The reed fliers got some help by physically pulsing the transmitter control sticks. Some, like Walt Good, developed a rudimentary system that pulsed the servos, but it was quite complicated. We should know, however, that the desire for propo and even a second control was achieved in a "Rube Goldberg" sort of way, back with the early single-channel systems.

With early single-channel, the most popular actuator was the escapement that Bonner developed to add auxiliary controls. With this, you keyed the radio frequency signal on and off, counting the "beeps" to get the desired control action. Often, the human element was removed because a mechanical "beep box" performed the task for you as you moved its control stick. Note

that, as far as the radio coding was concerned, even this system was a form of pulsing.

Beyond escapement systems was another fairly widely used concept that recognized the value of propo and the assets of using an electric motor as an actuator. Today, there's a multitude of miniature electric motors available (as shown by the variety of types and sizes of servos we have). This wasn't the case earlier, so finding a



A typical mechanical control hookup used with Galloping Ghost systems. The motor torque-rod crank operated both control yokes.

useable motor was a problem.

In early times, a major part of R/C was experimenting. Many spent as much time trying to conjure up something better as they did flying. It was called "bench time," and much midnight oil was burned. It was considered a breakthrough when some of these people found a small, adaptable English motor called the "Mighty Midget." It soon became the basis of most of the propo systems that were developed.

PULSED PROPO

The first pulsed propo systems were strictly for a single control and rudder only. This concept added a "pulser" box to the transmitter; it could turn the radio signal on and off in a controlled fashion. The pulser box contained a printed circuit-style switch or a simple drum similar to those in music boxes that opened and closed a signal switch. Innovative as modelers are, several

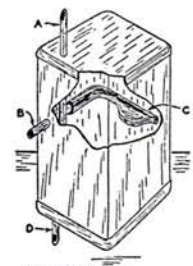
mechanical pulsing concepts were used. One that comes to mind used a tapered drum against which the control stick rode under some pressure. As the stick moved from the drum's small end to its large end, its speed of rotation would slow down. The effect was that the number of pulses per second could be varied over a useable range. This was called "variable rate." So, with a means of sending a rate code, how was the code discriminated in the airborne system?

No special receiver was required, but it had a double-throw relay as its output, (the same as was used with escapements). The relay controlled two actuator batteries: one battery's *positive* side connected to the relay's normally closed pole, and the other battery's *negative* side was connected to the relay's normally open pole. The relay's armature was connected to one side of the actuator motor so that the relay could switch polarity to the motor. There was also a common connection between the batteries that went to the other motor terminal. Thus, with pulsing, the motor would turn first one way, then the other.

To complete the arrangement, there was

(Continued on page 36)

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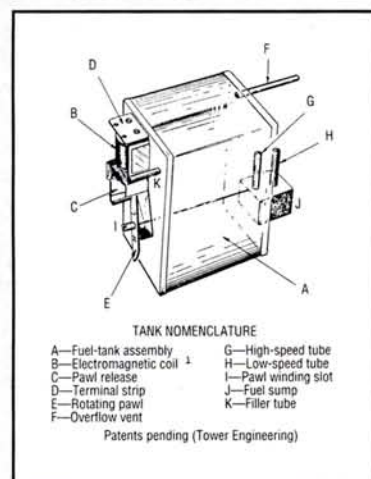
Here's the original Dmeco swivel tank. It pointed the way to today's R/C tanks.

How did the fuel tank that you take for granted originate? Fuel tanks were a problem from the beginning. The first engines came with attached tanks that soon proved impractical for various reasons. Separate tanks for free flight caused little trouble, and even the first control-line models got along without anything special—until inverted flight was achieved. Then the need for something better became paramount.

Dmeco met the need with a tank that incorporated an internal, weighted swivel that reacted to the same force that affected the fuel.

Problems quickly became apparent when R/C arrived. Dmeco's swivel design met the need, and their refined metal "positive flow" tanks did the trick. From there, the less expensive plastic "clunk" bottle tanks took over. Today, we have a vast variety of shapes and sizes, but they all use the original operating principle.

Earl Poynter of Ft. Worth, TX (one of our vintage R/Cers), sent us an example of an even earlier tank that has to be the acme of complexity. There were very few simple solutions to early



Installation diagram for the Selectronic tank.

usually a light rubber band or a spring that would return the motor armature to a neutral position. To set up the system, the pulser stick was locked in neutral, and the pulser motor speed was adjusted so that the receiver relay pulsed at the proper rate to suit a neutral actuator motor position. The rudder would move in both directions and make the plane fly straight. The rudder was

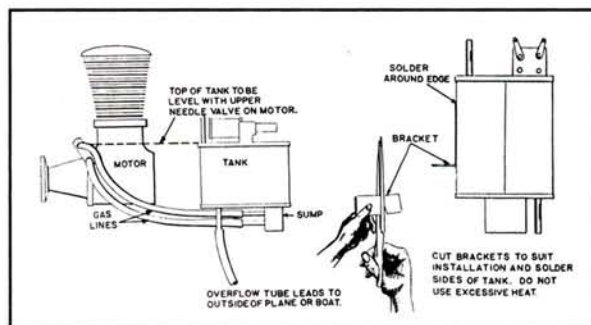
said to be "nervous" as it flopped away. After that, when the stick was moved to one side, the pulse rate quickened and caused the actuator motor to see more of one voltage potential than the other. The rudder then flopped to that side more often and the model would turn.

Moving the stick in the opposite direction reduced the pulse rate with an oppo-

needs! One of the first engine speed controllers used two needle valves—one for high and the other for low. The "low" valve was simply adjusted very rich to give about a 50-percent reduction in rpm. This created a need to switch from one valve to the other. Normally, this was done with a rubber-powered escapement to operate the valve between the tank and engine (rather complex and tough to find room for).

The Selectronic fuel tank was offered as a better solution. As the diagram shows, this tank had two outlets and a valve to open and close them (this was operated by an escapement like electro-magnet). With a master compound escapement the tank's control valve could be actuated.

Being unable to see inside our example, its operation is a bit of a mystery. The instructions tell you to start the engine with



The Selectronic fuel tank of the early '50s was developed to suit the first two-needle-valve R/C engine speed controller.

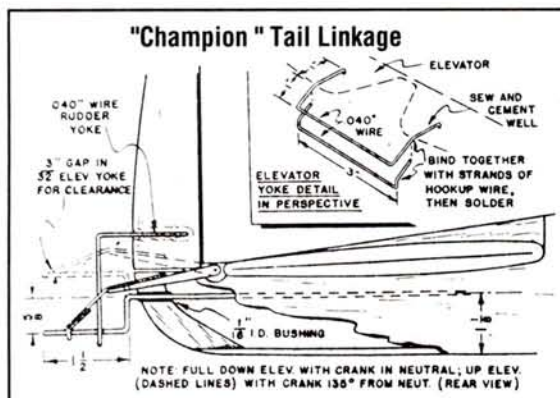
the valve in the high-speed position, then, to get low speed, just "blip" (a quick on-off of the transmitter key) the master escapement's auxiliary control position. (Actually, it was three blips with Bonner compound.) For engine shut-off, the third position was held, not blipped. Apparently, the valve had three positions: one and two switched the needle valves, and the third left both outlets closed, shutting off all fuel flow.

As advertised, the more efficient design of the Selectronic tank combined several separate components into one compact unit, with the addition of engine shut-off. It probably did the job well. Too bad for Tower Engineering that the carburetor was adapted so quickly!

site effect. With the ability of the pulser to create minute voltage changes, the control responded in a propo fashion.

Some pulsers had an additional feature that created a steady "on" or "off" signal at stick extremes so that you could fly "bang-bang" style when you wanted to. Other pulsers had a separate switch that created a steady signal. This was used for motor con-

control by way of a capacitor discharge circuit. Closing the switch for several seconds would charge the capacitor, and the discharge would "blip" the motor escapement to the next position. Naturally, there was a time delay, and during it, you had a hard-over rudder, but a judicious pilot anticipated all that, and it was better than no control at all.



Details of John Worth's Simpl-Simul linkage used on his current Live Wire Champion.

ELUSIVE ELEVATOR CONTROL

As success with these single-control pulse systems grew, the desire grew for that elusive elevator control. Somehow, could a method be found to get even more from a single radio frequency signal? It's said that Don Brown and his New Jersey cohorts first contrived a mechanical means of mixing rudder and elevator controls. Apparently, John Worth and Company in Virginia quickly followed the lead. The seemingly crazy appearance of the control actions with these systems quickly earned them catchy names. How about "Galloping Ghost," "Kicking Duck," "Wig Wag," or Worth's sophisticated "Simpl-Simul"? Their initial success probably created more bench time for R/Cers nationwide than any other innovation. Midnight oil was a widely used commodity!

The basis for this system was a noted characteristic of the original pulse pro-

portional concept. It was found that control was adequate when the rudder had *no set neutral*. The flight direction would be straight when the rudder flopped equally in both directions. A turn was made when the rudder flopped in larger arcs to one side than it did to the other. Obviously, the control's torque-rod crank was constantly in action. As Worth's label for his invention indicates, adapting this feature to elevator control was simple.

As the sketch shows, the mechanical connection that coupled the elevator to the torque-rod crank was as simple as could be. With this connection, the elevator now flapped in unison with the rudder, and elevator control was achieved.

As you can imagine, mixing the two controls required a special setup for the model. The model had to be arranged to suit the control action instead of the ac-

(Continued on page 38)

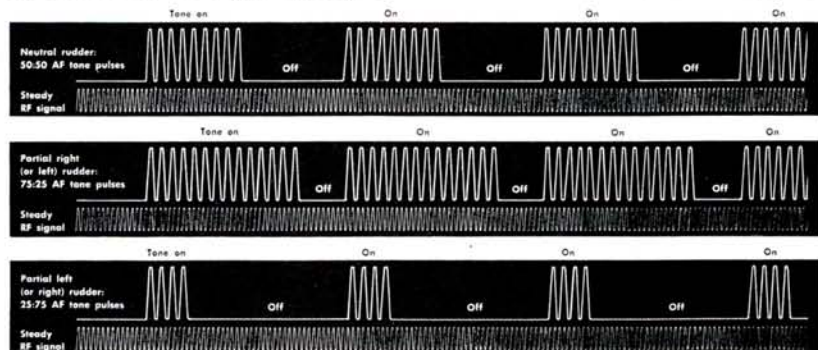


Diagram of pulse proportional transmitter coding. Top: the pulses are equal—neutral. Center: more pulses per second—one control direction. Bottom: fewer pulses—opposite control direction.



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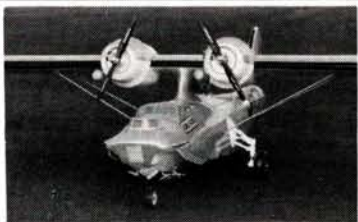
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GOLDEN AGE OF R/C

tion being suited to the model. For example, effective down-elevator usually occurred when the rudder action was neutral. No way, you say? The catch was that a normal "rudder only" R/C was set up to climb slightly in straight flight. So the down position only gave level flight or a slight descent. When rudder was used for a turn, some up-elevator was present—actually, not a bad feature. Remember that a little "up" keeps your nose level in a turn?

Proponents of this system claimed that it was the simplest and least expensive way to get propo control. What they *didn't* mention was the effort required to obtain it!

Obviously, considering how the controls wagged, it took some know-how to adjust the system and the model for flight. It was said that it could take at least three crashes before all was in proper order, but that the results were worth it!

Considerable dexterity was also required to operate it. This was no place for a beginner! You always had to anticipate what the control actions would be and compensate for them. Some fliers developed a real aptitude for pulse-propo and were able to accomplish the most basic maneuvers, including inverted flight!

So where did the weird names like Galloping Ghost come from? The pulse rate of these systems had to be relatively slow—slow enough for the model to react slightly to the flopping. As a result, the model didn't fly steadily and the tail oscillated when the flight path was straight—much like a horse galloping instead of walking. It was small price to pay for so much control.

This was the very early pulse system. Rapid development brought electronics into the picture for pulsers and switching circuits. Many of the shortcomings and discrepancies disappeared. Fortunately or not, digital proportional arrived, and it did the job much better with much less effort!

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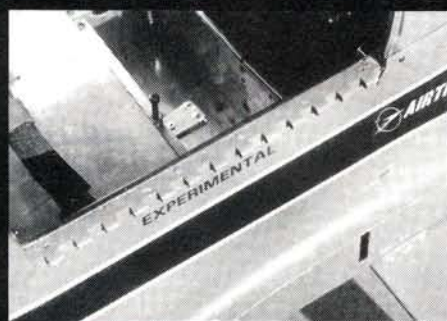
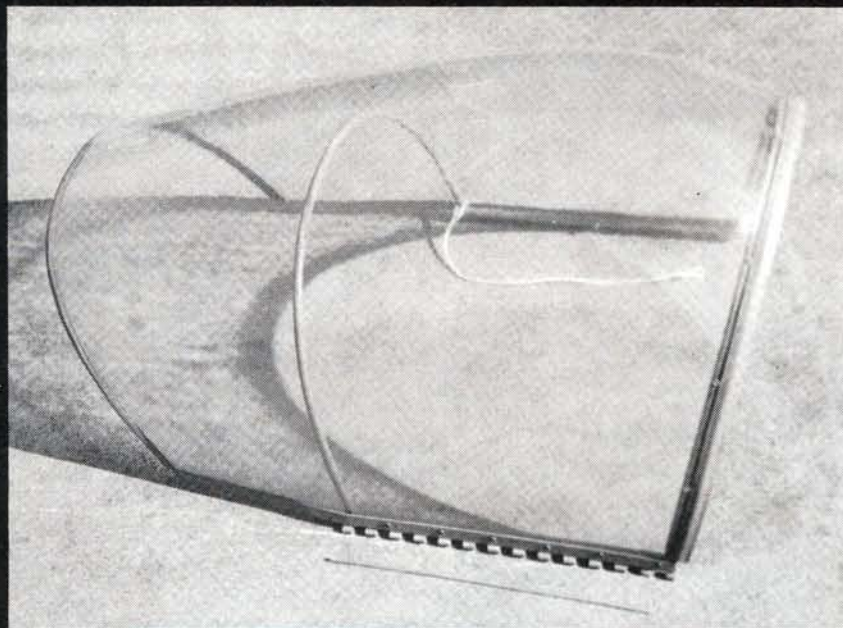
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◀ An aluminum piano hinge allows the canopy to be removed from the fuselage.

PHOTOS BY JERRY NELSON

▲ The canopy is attached to the aluminum tube canopy frame with no. 1 sheet-metal screws. Note the cockpit molding seal at the front and rear of the canopy.

HOW TO

Build a Functional Giant-Scale Canopy

by JERRY NELSON

A REALISTIC opening canopy for a medium- to large-scale model can easily be fabricated using a frame made of aluminum tube and an aluminum piano hinge. Described is the canopy frame design used on my AL-1 aircraft. For your reference, the AL-1 has a 97-inch wingspan and a fuselage length of 72 inches.

The AL-1 canopy design is found on many full-scale aircraft. The front, permanently affixed portion, is flat sheet plastic (.040-inch-thick vinyl) simply bent as required. The rear, movable portion, is shaped over a mold. (Information on how to form a canopy is covered in the May '92 issue of *Model Airplane News*.)

FRONT WINDSHIELD

The front windshield assembly is made first. Assuming the canopy is formed, the first step of the fabrication

process for the front windshield is to make a pattern for the windshield using thin cardboard or stiff paper card stock (old file folders work fine). By trial and error, arrive at the shape desired. You can tape the paper pattern to the fuselage and to the formed canopy to see if it looks right. The height of the front windshield is critical; it must properly match the front bow of the movable section.

Cut out the actual windshield

from .040-inch-thick clear plastic. I recommend vinyl because it's inexpensive and readily available.

With the plastic windshield taped in the correct position, fabricate the $\frac{3}{16}$ -inch-diameter aluminum-tube windshield bow. The material used is 2024 T-3 aluminum ($\frac{3}{16}$ -inch-diameter x .049-inch-thick wall). This aluminum will be used for the rest of the frame.

Make a pattern of $\frac{1}{4}$ -inch-thick

plywood. Transfer the shape of the windshield onto the plywood and cut and sand the plywood as necessary. Cut a length of tube longer than necessary. By hand, bend the tube to match the plywood template. You have to bend it more than the template requires, because the tube will spring back a little. The hard part is to make both sides of the bow the same. The bow should match the pattern closely because, later, the

(Continued on page 40)

Tips on fabricating metal hinges, fairings and latches



▲ The finished canopy in the closed position.

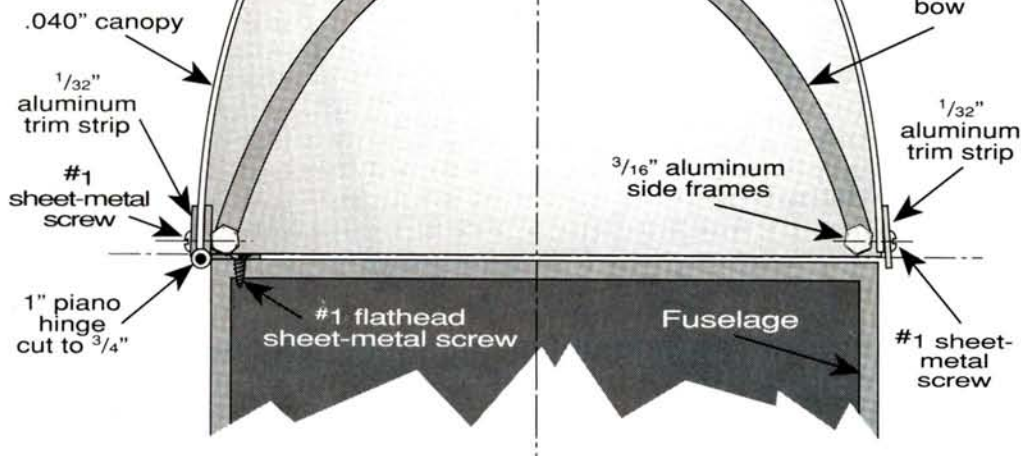
Build a Functional Giant-Scale Canopy

Detail showing hinge & canopy frame at fuselage intersection

canopy bow on the movable part of the canopy will have to fit the same template.

Trim the ends of the windshield bow so that they just touch the fuselage cockpit area and the top of the windshield. In each end of the bow, cut a $\frac{1}{32}$ -inch-wide x $\frac{1}{4}$ -inch-deep slot parallel with the fuselage. The slot will be used to attach the windshield bow to the fuselage by way of a 90-degree bent metal tab that's approximately as wide as the adjacent canopy bows. The correctly formed aluminum bow is now taped to the windshield and to the fuselage. Fabricate a suitable angle tab of $\frac{1}{32}$ -inch 2024 T-3 aluminum or $\frac{1}{32}$ -inch 4130 steel. It will be screwed with no. 1 sheet-metal screws to a hardwood support that's attached to the inside wall of the fuselage. Drill a hole (about $\frac{3}{32}$ -inch from each end of the bow) that goes through the bow and into the $\frac{1}{32}$ -inch metal angle tab. The drill-bit size should be correct for a no. 0 or no. 1 screw, or for a $\frac{1}{16}$ -inch-diameter aluminum rivet. The bow is attached to the fuselage at these single pivot points. The bow can be moved fore and aft quite easily and seems somewhat insecure at the moment, but as soon as you attach the windshield to the bow, everything becomes very sturdy.

Next, attach the windshield to the frame with no. 0x $\frac{1}{8}$ -inch or $\frac{3}{16}$ -inch-long flat or round-head sheet-metal screws. Use masking



tape to attach the windshield in the correct position to the bow and fuselage. Let the windshield protrude aft of the bow about $\frac{3}{16}$ inch. This allows for some trimming and provides a place for the cockpit fairing strip to rest.

After the windshield has been attached with tape, mark the locations for the sheet-metal screws. Position the screws about 1 inch apart. Make certain that the hole spacing is symmetrical on each side of the frame. If using flat-head screws, countersink the windshield by hand, with a suitable drill bit that's about $\frac{3}{16}$ inch in diameter. Install the screws.

FAIRING STRIP

A fiberglass- and-resin fairing strip is fabricated next. The fairing

will be molded directly onto the windshield and fuselage. No pattern or mold is necessary. To keep the resin from sticking to the fuselage and windshield, coat the area of the fuselage around the windshield and the bottom of the windshield with wax. Use a release wax found at fiberglass/resin suppliers. Put several coats on the fuselage and the windshield.

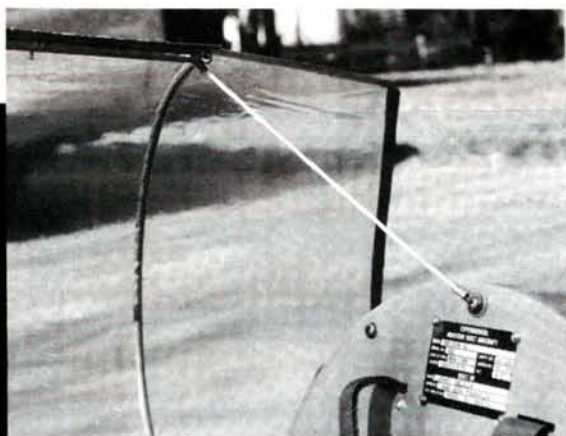
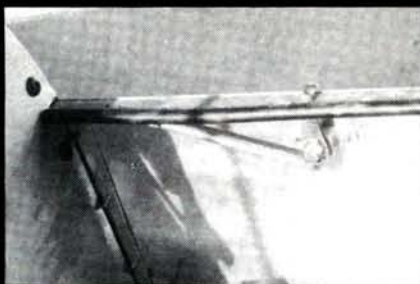
Run a piece of fiberglass strapping tape from the top of the windshield canopy frame forward to the firewall. Don't use masking tape, because it will stretch and break easily. The tape will pull the windshield down onto the fuselage and still allow room for you to work around the joint of the windshield to the fuselage.

Fabricate the fiberglass fairing strip with a piece of 1-inch-wide fiberglass tape cut about 1 inch longer than necessary. Mix up some polyester surfacing resin and hardener, and saturate the fiberglass tape prior to putting it in place. A piece of glass plate works well for applying the resin. Lay the fiberglass tape on the glass, and then saturate the fiberglass with resin. The resin will come off the glass easily later.

Place the freshly saturated (not cured) fiberglass strip around the joint of the windshield and fuselage. Half the glass will be on the fuselage and the other half on the windshield. Don't worry if it isn't exactly in position, because the fiberglass tape will be trimmed to

a narrower width later. The tape will stay in place (it will stick to the wax surface). After the resin has set (several hours for a full cure), sand the tape with some 60-grit sandpaper. Be careful not to sand into the fuselage or windshield. If you accidentally scratch the windshield, don't worry. (You can make another windshield using the scratched one as a pattern.) A layer of medium-weight 2-ounce fiberglass cloth cut about $1\frac{1}{2}$ inches wide is coated with resin over the 1-inch-wide fiberglass tape. The

► The canopy is held open with a thin nylon cord. Note the locking pin in front of the canopy bow.



◀ Detail of the locking mechanism as seen on the inside of the fuselage. Note the spring that keeps the lock closed.

additional fiberglass cloth's main purpose is to provide a smooth finish over the 1 inch fiberglass tape.

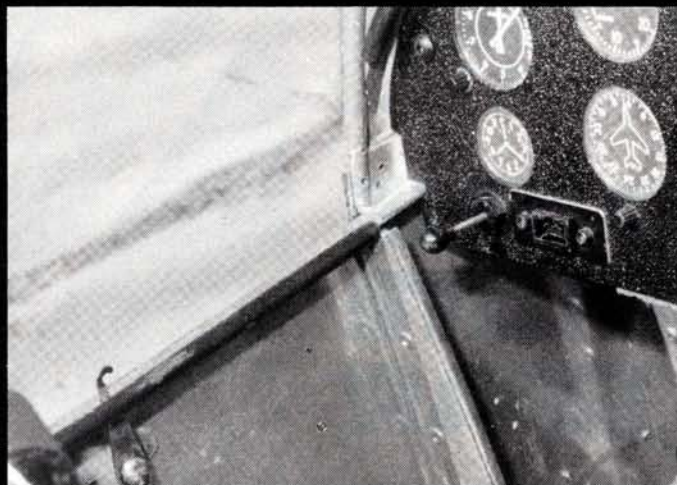
After the resin has fully cured, sand the fairing smooth. Insert a thin spatula between the fairing and windshield/fuselage junction. The fiberglass will pop loose quite easily. Now the fairing can be correctly trimmed to a width of $\frac{5}{16}$ to $\frac{3}{8}$ inch on each side. Tin snips work quite well for the trimming operation. The fairing will be reasonably strong, but be careful during the cutting and sanding operations. After sanding, go over the fairing with another coat of resin.

ATTACHING THE CANOPY

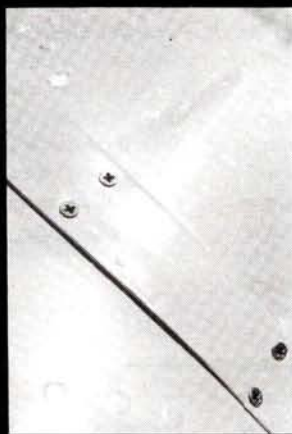
Attach the front windshield and the fairing to the fuselage with no. 1x $\frac{1}{4}$ -inch-long round or flat-head sheet-metal screws. These go through the fiberglass fairing into the windshield or through the fairing and the fuselage. Carefully position the screws so that they're about 1 inch apart and are spaced symmetrically on each side of the canopy. Countersink the holes if flat-head screws are used. Countersunk screws aren't necessary, but they certainly look better.

Reinforce the fuselage from underneath with fiberglass cloth or hardwood inserts to support the fairing screws. The screws can be tightened without stripping the windshield and fuselage if some reinforcement is provided. Experiment with different size drill-bits for the screws. Make the smallest hole that will still accept the screw.

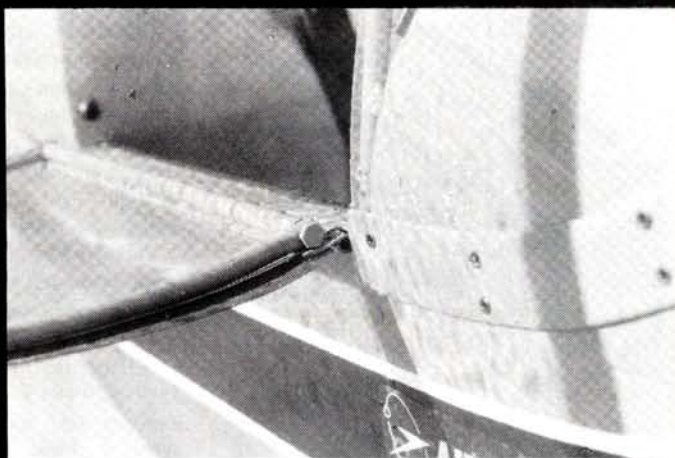
The entire canopy, bow, and fairing strip can be disassembled later for painting.



▲ The 90-degree angle tab anchors the canopy bows. ▼ Detail of fiberglass fairing strip attaching the windshield to the fuselage.



▲ The canopy locking system in the closed position. Note the locking mechanism in the upper part of the photo.



▲ Here, you can see how the aluminum-tube front canopy bow is attached to the main frame tube with a 4-40 screw. Note how the fiberglass fairing strip is used to hold the windshield in place.

MOVABLE PART OF CANOPY

The frame is constructed of the same aluminum as the front windshield bow.

Form the front bow portion of the canopy over the same pattern used with the front windshield. Leave it longer than necessary for now. It should match the front bow as closely as possible.

Next, form the rear bow. No pattern is necessary because it doesn't have to match anything. The shape of the rear bow on the AL-1 is determined by the fuselage turtle deck. The rear bow could be eliminated on some designs, and you would just have a straight piece going from each side.

Cut to the proper length two $\frac{3}{16}$ -inch diameter parallel portions of the frame that run along the base of the canopy. Allow space for the two $\frac{3}{16}$ -inch-diameter bows. Each end of the paral-

el portions are tapped with a 4-40 tap about $\frac{3}{8}$ to $\frac{1}{2}$ inch deep. The inside diameter of the tube is the right size for the 4-40 tap. With a small, round, rat-tail file, file $\frac{1}{2}$ -inch round grooves vertically in this tube to accept the canopy bows.

The canopy bows are now attached with 4-40 screws about $\frac{3}{8}$ inch long. Drill no. 33 holes in the ends of the bows at the right spot so that the 4-40 screws will hold the bows in the correct position. The front canopy bow will have to be slightly higher than the windshield canopy bow owing to the curvature of the canopy. Minor adjustments can be made by bending the bows or screws. The ends of the bows are cut and filed flush with the bottom of the parallel frame tubes.

The canopy frame should sit on the fuselage and fit properly without forcing it to the correct shape.

HINGING

Cut the $\frac{1}{16}$ -inch aluminum piano hinge to length. Trim the width to $\frac{3}{8}$ inch on each side. Steel and aluminum $\frac{3}{4}$ -inch piano hinges are available from some specialty suppliers, but can be difficult to obtain. The cut-down $\frac{1}{16}$ -inch size works satisfactorily. The hinge is attached with no. 1 flat head screws to the fuselage as shown in the cross-section drawing.

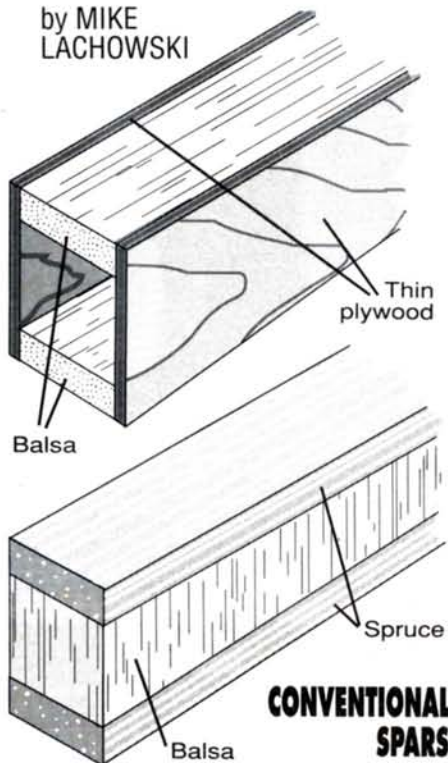
The trimmed canopy is now placed in position onto the frame. Final fitting of the canopy is required, especially where it touches the front windshield. The canopy doesn't have to fit perfectly, but do the best you can. The molding strips will take care of minor errors in the fit. The canopy should overlap the canopy frame about $\frac{3}{32}$ to $\frac{1}{8}$ inch. This is to allow for the canopy molding. Tape the canopy in position on the sides to

(Continued on page 73)

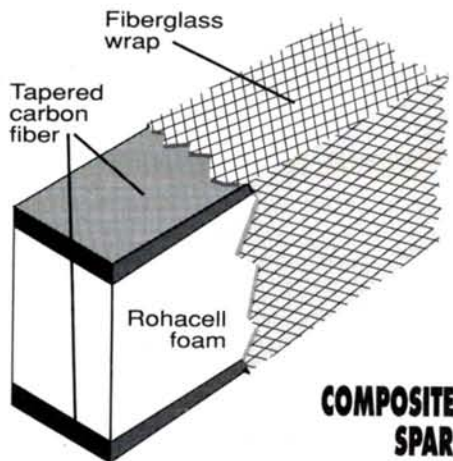
HOW TO

BUILD THE ULTIMATE WING SPAR

by MIKE LACHOWSKI



CONVENTIONAL SPARS
Conventional spars are built by gluing balsa between the two spars or by gluing balsa or plywood to their edges.



COMPOSITE SPAR
The composite spar is built by gluing Rohacell between the two carbon-fiber spar caps and wrapping the spar with fiberglass or Kevlar.

MOST WINGS have spars that strengthen them. Many of you are familiar with applying a thin carbon-fiber laminate to an existing spar to enhance its strength, but you can make the wing even stronger—yet lighter—by using an all-composite spar.

The spar has three parts: a top, a bottom and a shear web. The top and bottom parts of an all-composite spar are carbon-fiber laminates. The .007- or .014-inch-thick laminates you use for conventional spar reinforcements aren't thick enough to strengthen the spar sufficiently and make it resistant to buckling. Composite Structures Technology* (CST) offers laminates (with tapers or without them) in thicknesses up to .060 inch. In addition to strengthening the wing where it needs it most—in the center—tapered laminates reduce weight and save you money. Tapering conventional spars

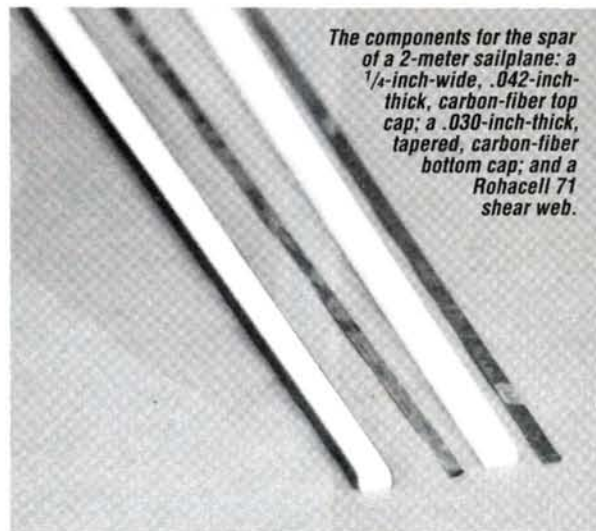
is difficult because it's hard to make the taper gradual and even. The taper is built into a composite during the laminating process, and because the spar requires less carbon fiber, it costs less to make.

Make the shear web of Rohacell instead of balsa.

Stronger and lighter!

Rohacell provides the necessary strength, but it's lighter and easier to work with than balsa, e.g., when you taper such a web you don't have to worry about the grain. Glue the carbon fiber to the

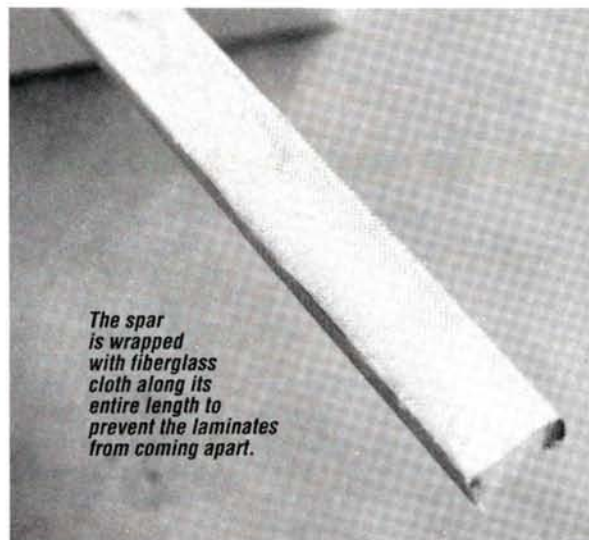
The components for the spar of a 2-meter sailplane: a 1/4-inch-wide, .042-inch-thick, carbon-fiber top cap; a .030-inch-thick, tapered, carbon-fiber bottom cap; and a Rohacell 71 shear web.



Rohacell with epoxy or CA. If you use CA, make sure that the bond is good. Epoxy gives you more time in which to work and reduces the likelihood that you'll make a mistake.

A fiberglass or Kevlar spar wrap applied to the center section will strengthen the spar even more and prevent the carbon fiber from pulling away from the Rohacell. I tack-glue the fiberglass to the spar by spraying the spar with 3M 77 adhesive and wrapping the fiberglass around it. Then I apply epoxy with a foam roller to "wet out" the cloth and complete the spar. I usually attach the spar to the foam-cores at the same time.

CST offers carbon fiber in a variety of thicknesses and widths. You can design the spar to carry the entire wing load, and this permits you to reduce the weight of the wing sheeting or cloth lay-up when you vacu-bag. The cloth lay-up can be as little as one layer of 1.8-ounce Kevlar and one layer of .75-ounce fiberglass. The Kevlar is a good choice here, because it provides a thicker, more durable finish. In the end, the carbon fiber/Rohacell spar is stronger, yet lighter, than one made of spruce, carbon fiber and balsa. This approach will result in a lighter wing with a spar that carries the entire load.



The spar is wrapped with fiberglass cloth along its entire length to prevent the laminates from coming apart.

*Here's the address of the company mentioned in this article: CST, P.O. Box 4615, Lancaster, CA 93539.

AIRTRAX^{L&R}.46

The
Next
Generation?

PHOTOS BY JOHN JUNDT



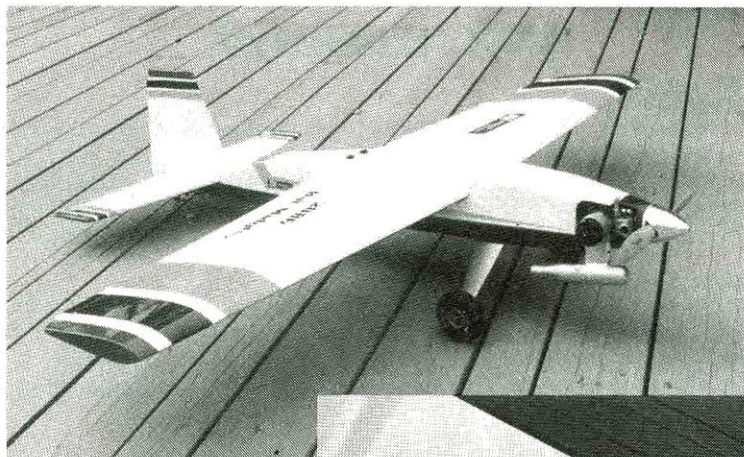
BELIEVE THAT L&R Aircraft* has a winner on its hands. The Airtrax .46 is designed to be the airplane that you want to fly. To ensure minimum building time and maximum flying time, the people at L&R Aircraft do a lot of the work for you.

As you pull items out of the plain, brown box, you find that the fuselage is pre-built, except for the top deck. The horizontal stabilizer is also built at the factory. The smaller

parts that are necessary to complete the kit are taped neatly together in the order in which they'll be assembled.

The next thing that I noticed was the quality of the wood. Many times, I've opened kits and not been happy with the quality of the wood. That wasn't the case here. All the wood in this kit was of excellent quality and appropriate for the job it was intended to do.

• by BILL MIDGLEY •



With its nearly equal tail and nose moments, the Airtrax .46 could be the future of sport flying.

AIRTRAX .46

SPECIFICATIONS

Model name: Airtrax .46
Manufacturer: L&R Aircraft
Type: Sport monoplane
Price: \$159.95
Wingspan: 51 inches
Wing area: 500 square inches
Wing loading: 23.4 ounces per square foot
Weight: 4 1/2 to 5 pounds
Length: 41 inches
No. of channels req'd: 4 (aileron, elevator, rudder and throttle)
Radio used: JR PCM
Power req'd: .40 to .46 2-stroke
Engine used: YS .45
Prop used: Top Flite* 10x8
Airfoil type: Symmetrical
Washout: Not built-in
Wing construction: Foam-core with balsa sheeting
Kit construction: Balsa and plywood

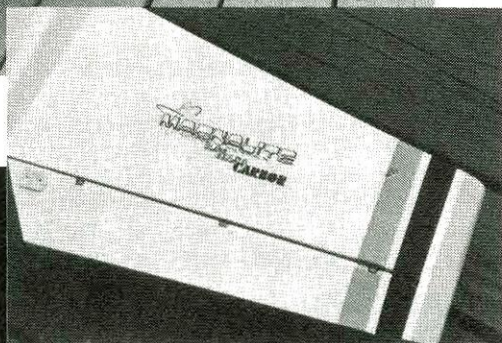
Features: among the attractive features of this easy-to-build, enjoyable plane are a jig-built fuselage, pre-cut foam wings and one-piece, pre-formed balsa skins.

Hits

- high degree of prefabrication
- high-quality wood
- excellent flight characteristics

Misses

- The manufacturer-specified throws are for advanced pilots only.
- A set of scaled-down plans would be nice, but it isn't necessary.



Bob Violett's Magnalite was used in high-stress areas such as the wing center section. The entire model was covered with Masterkote, which is available from Sheldon's Hobbies.

The only hardware that comes with the kit is the landing gear and the tail-wheel mount, so a trip to the hobby shop is in order. I didn't think this was an inconvenience;



The faired-in engine contributes to the aerodynamically clean design. The model will perform its best with 2-stroke motors.

I like to work with hardware that I'm comfortable with, not something the manufacturer got a good deal on.

CONSTRUCTION

There are no scale plans with this kit. The minimal building that's necessary to complete the model eliminates the need for scale plans, but I'd like to see a small drawing with some basic layout information on it. The seven-page instruction

booklet gives you plenty of information to get the job done.

The wing was the first thing to be built. (You'll need it to check the incidence of the horizontal stabilizer and complete the fuselage.)

The wing is a foam-core that's sheeted with one-piece balsa skins. I attached the skins to the foam-cores with Z-Poxy* finishing resin. I've used this product and method on the jet wings that I've built, and I haven't had any problems yet. After you've figured out which side of the sheeting you want next to the cores, spread a very thick coat of resin on the sheeting. Lay the core on the wing skin with a rocking motion, and make sure that the core is centered on the skin. Repeat the process for the other side of the core, and place the assembly in the saddles in which the core came. I do both wing halves at the same time and then place a 60- to 70-pound weight on the saddles for at least 24 hours.

When you remove the weight and take the wings out of the saddles, you'll be amazed at the light, strong structures you've produced. Now trim the wing skins back to the size of the cores, and you're ready to epoxy the triangular-stock leading edge, square trailing edge and solid-balsa wing tip to the wing half. I used Z-Poxy epoxy because it has worked well for me in the past.

After each wing half has been

completed, but before you join them, decide if you're going to use one or two servos for the ailerons. I use two—one for each aileron. I feel I have better control over the aircraft's trim with this method. Now is the time to cut the wing to place your servos. Remember, the servo leads must reach the root of the wing. After you've cut the hole for the servo, bore a hole

from the root of the wing to the servo hole for the servo lead. I usually run a small piece of string through this channel to help pull the servo lead back to the center of the wing when I'm ready for the actual radio installation.

Now, epoxy the wing halves together. This is a critical joint for the strength of the wing. For a little insurance, I add a small amount of milled fiber to the epoxy mixture. (It increases strength tremen-

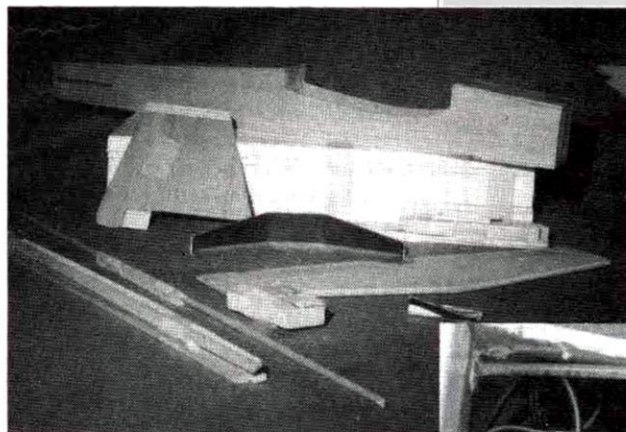
AIRTRAX .46

dously.) Check your hobby supplier for it, or order it directly from Bob Violett Models*.

Spread a liberal amount of epoxy on the roots of the wing, and align the leading and trailing edges, secure them in a fashion that you like, and set the assembly aside until the epoxy has cured. Finish the wing hold-down system, and you've finished the wing.

Install the wing on the fuselage, and check the incidence and overall squareness of the flying surfaces to the fuselage and to each other. Do this at least three times, and be very picky about getting it right. A little extra time here can make all the difference in the world to how the aircraft performs in the air. Once you're satisfied with the location of the tail feathers, use CA to hold them in place.

Work out the controls for the elevator and the rudder, and then attach the top decking of the fuselage.



A high degree of precise prefabrication speeds construction. All balsa is of high quality.

Install the power side of the aircraft, form the cowl around your engine, and blend it into the fuselage. You've finished the construction!

COVERING

I used Masterkote for the covering on this project. It's a great new product from Sheldon's Hobbies*, and it's about \$4.50 a roll cheaper than some of the other coverings on the market today.

With the finish I used, orientation during flight isn't a problem. The top and upper sides of the fuselage are white, and the lower fuselage sides are navy blue. A

FLIGHT PERFORMANCE

• Takeoff and landing

A slight amount of right rudder is required to correct for engine torque during takeoff, which is very smooth. The tail doesn't come up like those on most tail-draggers. The aircraft lifts off and lands in pretty much the same attitude that it sits on the ground. One thing that's quite different about this aircraft is the way it lands—like a good pattern plane. A long, low, slow approach is necessary.

• High-speed performance

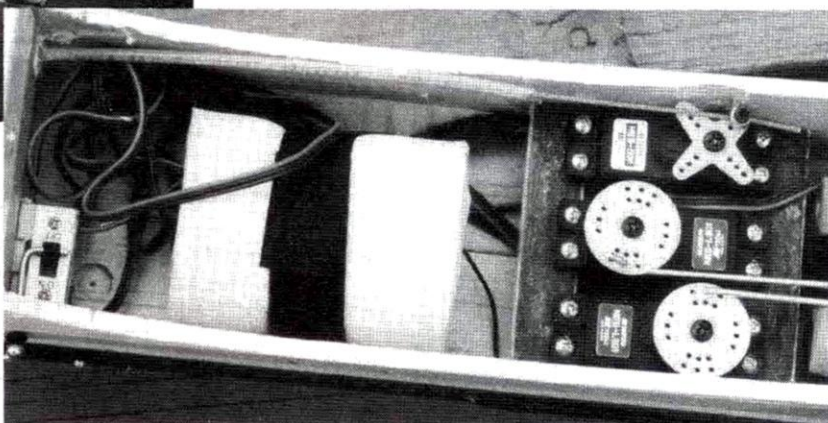
The Airtrax .46 is marketed as a high-performance sport airplane, but it has the tendencies of a good pattern aircraft. It tracks exceptionally well at all speeds. It will build your confidence and ability because it won't surprise you. Power-on stalls aren't violent, and as soon as air speed is recovered, all flying surfaces bring the ship under control.

• Low-speed performance

Slow-speed performance isn't much different from high speed. Add a couple of clicks of up-elevator, and the Airtrax is right at home moving slowly. Slow-speed stalls are very manageable. When the aircraft falls off to the left, neutralize flying surfaces, and as the air speed builds, the plane will recover. At dead-stick, this aircraft will surprise you. It doesn't bleed off air speed very quickly, so you don't need to panic and head right back to the field. A couple of loops and a horizontal roll later, you should be ready for approach to landing.

• Aerobatics

Anything you can do, the Airtrax will do. Inverted flight is achieved by simply adding about one-quarter down-elevator. With surface control rates at factory specs, snaps are breathtaking. The airplane appears to stop all forward motion and twist itself in two. Knife-edge flight is easily performed with the appropriate rudder deflection and about 4-percent up-elevator mixing. As I said, the Airtrax will do it all if you know what should be done. The factory recommendations for surface throws are: aileron— $3/4$ inch; elevator—1 inch; rudder—1 inch. I found these rates to be radical, so I set up the low side of my dual rates to half of the factory recommendations. When practicing pattern maneuvers, I use the low rates; I use the high rates when I want to go out and really see what this aircraft can do.



Work out the radio installation after you've installed the engine. Owing to the plane's long nose moment, you may have to place the battery far aft if you use a heavy engine.

hot red $3/16$ -inch pinstripe separates the white and the blue. A hot green accent stripe crosses the fuselage behind the wing and tapers to the nose of the aircraft. The wing and horizontal

stabilizer are white on top with stripes of hot red at the tips and then a stripe of navy blue and hot green. The underside of all surfaces is hot red.

(Continued on page 74)

ENGINE REVIEW

by MIKE BILLINTON

THE INCREASING popularity of scale models of jet-fighter aircraft continues to enforce developments of the ducted-fan 2-stroke model racing engine. Certain manufacturers are confident enough to view the production of a light, .80 or .90, high-rpm/high-hp engine as some sort of touchstone of their engineering competence.

The Rossi .90 is the third such engine to stretch dyno/operator/environment. The recently tested O.S. .91 DF unit established a fearsome 5.4hp as the current top marker, and the OPS .80 initially set the ball rolling for me with a high power-to-weight ratio of 3.26hp/pound.

Also in existence, but not yet sighted, are ducted-fan engines from Super Tigre (X90K) and Webra's Speed .80F. Performance parameter comparisons between some of these large-capacity racing engines are of interest; the chart shows the importance of power-to-weight ratio to ducted-fan aircraft and its relative *unimportance* in the marine sector. In the figures is evidence of a possible eye-opening result from the K&B V .82. This is apparently producing very high air speeds in straight-line runs.

Increased Reliability



The structurally solid Rossi .90 is proving to be a pace-setter in the ducted-fan area.

Any engine from Rossi is a serious affair, and the overall design and structure of the .90 is intended to keep the Rossi name in the forefront of racing technology. To this end, the balanced, steel, rotary-induction drum and the high exhaust timing and consequent large blow-down period of 30 degrees all lead us to envisage considerable power release at high rpm.

That it's 4 ounces (17 percent) heavier than the O.S. .91 VR DF is no surprise and suggests that Rossi is seeking to enhance the reliability of what are, by any standards, quite daunting machines.

Further evidence of this lies in the combustion-chamber detail, because the chart indicates that the Rossi .90 has a less demanding compression ratio and squish clearance than any of those I've tested. As a result, glow-plug life

Comparison of Ducted-Fan and Marine Engines

	ENGINE	BHP/CU.IN.	BHP/LB.	WT. (OZ)	SQUISH (INS)	ECR*
DUCTED FAN	OPS .80	5.53	3.26	21.7	0.028	7.6:1
	O.S. .91	5.99	3.41	25.3	0.019	8:1
	ROSSI .90	5.56	2.75	29.4	0.034	5.8:1
MARINE	Picco .90	5.50	1.96	41.0	0.009	11.4:1
	CMB .90	5.09	1.95	38.0	0.015	9.2:1
	K&B .67	6.61	2.94	24.0	0.012	7.7:1

*ECR—effective compression ratio

Note the extra transfer passage that has been squeezed between the main side transfer and the boost passage in the crankcase. The large-volume cylinder-head button suits high-nitro operation. Note also that the rear cover (at left, front) is an unbuffered alloy within which the solid steel rotor rotates.



during this test was noteworthy—only one was used throughout.

Designed for use with Byron's ducted-fan unit, it's likely that, in fixing this very mild combustion-chamber geometry, Rossi anticipated that many U.S. users will use higher percentages of nitromethane than are usual in Europe. Byron advises the use of 20 percent nitro; Rossi recommends 3 to 10 percent nitro.



The chromed-brass liner has extra side transfer ports with matching holes in the high-silicon piston; hence, the Rossi designation "3+2"—three standard transfers (two side, one boost) and two extra side transfers. Note that the steel rotor has been milled away on the outer surface to counterbalance the opening slot and allow smoother, high-rpm running. To increase the base crankcase compression, the counterweighted crankweb is filled in with carbon fiber. Note the separate pressed-in crankpin. The rod has bushings at each end.

An alternative reason can be offered for the markedly low effective compression ratio: as you may know, where considerable "supercharge" is anticipated from the particular engine/pipe combination, to prevent cylinder pressures from rising too high, the "static" compression ratio must initially be set at a low level.

Pipe response and combustion-chamber geometry in the .90 suggest, however, that the U.S. nitro effect is the one being anticipated. Conveniently though, the chamber is "ready to go" with possible future, more massive, pipe responses and their denser cylinder filling. (It really does appear to be an either/or situation.) The bottom line is that the Rossi .90 didn't, in this test, at least, reach Rossi's claim of 5.5hp at 22,000rpm. It's probable, though, that adjustments to squish and compression ratio would enable this to be achieved quite easily, but at some cost in reliability.

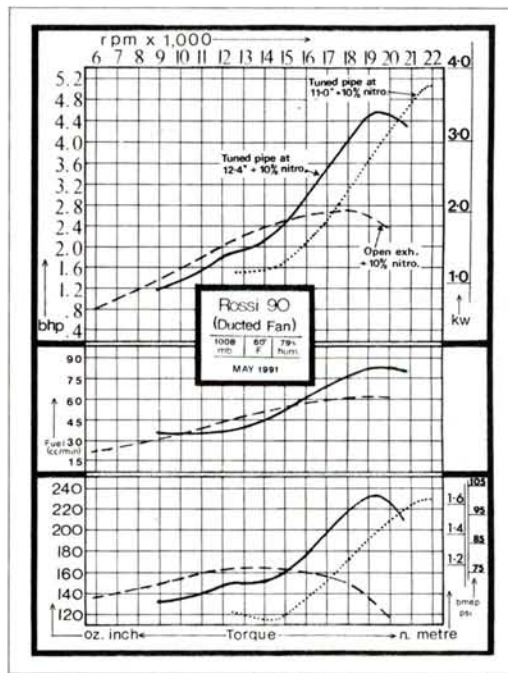
This is quite a familiar situation and explains the continuing reluctance of virtually all manufacturers (certainly in the racing-engine area) to specify the conditions of use when making claims. Given that it's possible to virtually treble the open-exhaust power output of a 2-stroke racing engine by using tuned pipe/raised rpm points/nitromethane, the lack of information from Rossi about the associated equipment used to achieve a claimed performance makes engine comparisons difficult.

It's very likely, for instance, that some manufacturers use figures obtained at the "unreliable" end of what's possible, while others will be operating "normal use" equipment when obtaining performance figures.

In almost all cases, reference to a manufacturer's instruction leaflet will ensure reliable operation, but according to my findings, only rarely will this "standard equipment setup" achieve the maximum power claimed.

PERFORMANCE

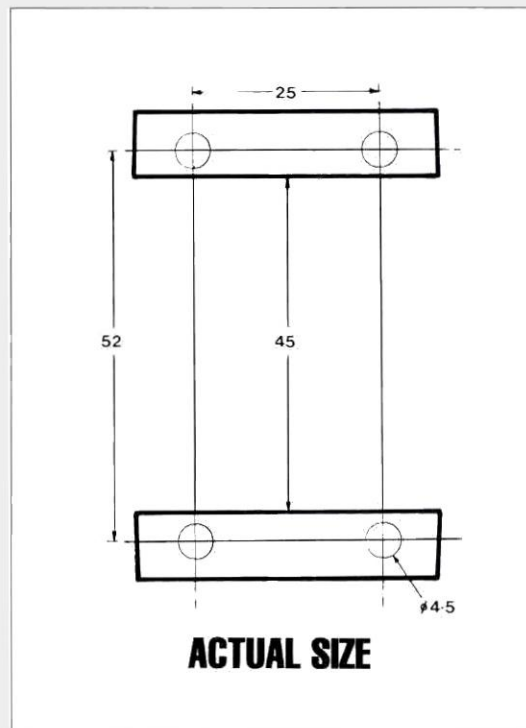
Rossi advises the use of 11x7 or 12x6 propellers for running-in, in which case rpm will be less than 15,000.



S P E C I F I C A T I O N S

WEIGHTS & DIMENSIONS

Capacity	0.9087 cu. in. (14.89cc)
Bore	1.064 in. (27.03mm)
Stroke	1.022 in. (25.96mm)
Stroke/bore ratio	0.960:1
Timing periods	Exhaust - 185° Transfer - 125° Boost - 125° Rear induction: —Opens - 36° ABDC —Closes - 57° ATDC —Total period - 201° —Blow-down - 30°
Combustion volume	1.77cc
Compression ratios	Geometric - 9.41:1 Effective - 5.83:1
Exhaust-port height	0.435 in. (11.05mm)
Cylinder-head squish	0.034 in.
Cylinder-head squish angle	1°
Squish-band width	0.150 in. (3.81mm)
Carburetor bore	0.414 in. (10.54mm)
Crankshaft diameter	0.590 in. (15mm)
Crankshaft bore	0.414 in. (10.54mm)
Crankpin diameter	0.275 in. (6.99mm)
Crankshaft nose thread	8x1.25mm pitch
Wristpin diameter	0.236 inch (6mm)
Engine height	4.8 in. (122.3mm)
Width	2.47 in. (62.7mm)
Length	5.45 in. (138.4mm)
Width between bearers	1.76 in. (44.7mm)
Mounting-hole dimensions	2.047x0.984in. (52x25x4.5mm)
Frontal area	9.52 square inches
Weight	29.4 oz. (834g)
Crankshaft weight:	4.95 oz. (141g)
Piston weight:	0.45 oz. (13g)
Performance:	
Max. b.hp	—5.05 @ 21,700rpm (Rossi t/pipe- 11 in./10% nitro) —2.74 @ 18,090rpm (open exhaust/10% nitro.)
Max. torque:	—235 oz/ins @ 19,330rpm (Rossi t/pipe-12.4 in./ 10% nitro) —165 oz/ins @ 13,526rpm (open exhaust/10% nitro)



RPM on standard fixed-wing propellers:

	Open exhaust	T/pipe-11 ins	T/pipe-12.4 ins
13x6 MK	11,910	11,151	—
12x6 APC	14,210	13,331	—
10x6 MK	16,400	18,430	14,300
10x6 APC	18,070	20,890	20,750
Byron fan	—	19,000	—

Performance equivalents:

b.hp/cubic inch	5.557
b.hp/cc	0.339
Ounce inch/cubic inch	258.6
Ounce inch/cc	15.78
Ounce inch/pound	127.9
Gram meter/cc	11.3
b.hp/pound	2.75
b.hp/kilo	6.05
b.hp/square-inch frontal area	0.53

Manufacturer: Rossi Motors, Cellatica, Italy. U.S. Distributor: Rossi USA, 214 Harvest Ave., Staten Island, NY 10310.

Reaching the rated rpm (above 21,000) means care in propeller selection. The APC propellers are certainly very strong, and the 10x6 will reach 20,000 with the .90 when the engine has a tuned pipe.

The rpm table shows the pipe's considerable boost in the 21,000 rpm area, and this surge of power arrives so quickly that the use of weaker propellers would be dangerous.

Test 1: Open Exhaust. Fuel: 10 percent

nitro/10 percent ML70 synthetic oil with 5 percent castor oil/70 percent methanol. Plug: Rossi R6.

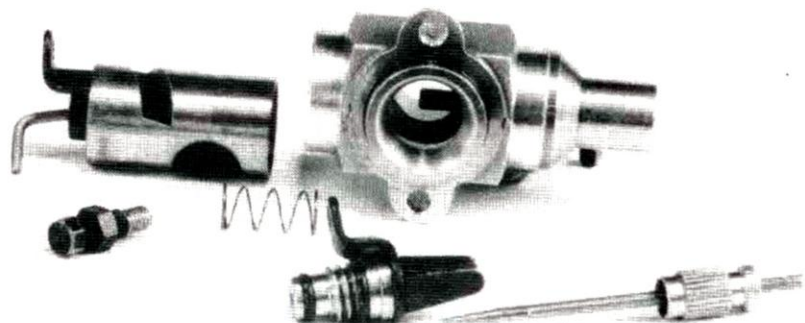
The .90's markedly high exhaust timing matches it to effective tuned-pipe operation at high rpm, and the very short power stroke available before the exhaust port opens (57 percent of stroke) will probably give relatively low power levels when the tuned pipe isn't used.

In this open-exhaust form then, both

torque and horsepower levels were quite repressed.

Test 2: Rossi unmuffled tuned pipe at 12.4 inches (plug to maximum diameter). Fuel and plug as in Test 1.

The Byron fan operates in "pusher" mode, so this "rear-exhaust" engine is actually back-to-front in the aircraft, and the usual tuned-pipe configuration therefore isn't suitable. So Rossi provides a "reverse-flow stinger" to allow final ex-



When the airplane is airborne, the .90's main fuel-needle control can be operated by an R/C servo that actuates the coarse-thread servo-arm unit. It gives an equivalent of one turn open or shut for just 60 degrees of servo travel—very useful for any model engine (particularly a tuned-pipe one).

haust gas to exit backwards through the blades of the pusher fan. As the engine itself flies through the air backwards at anything up to 200mph, it's imperative that the "rear" drum rotary valve pointing upstream doesn't suck in any foreign object. To ensure a long life for this engine, the Rossi carburetor intake air filter is essential.

Using the "standard" pipe length resulted in a lower-rpm full-resonance point and thus less horsepower than the maximum claimed.

Test 3: Rossi pipe shortened to 11 inches. Fuel and plug as in Test 1.

The previous test indicated the usual need to shorten the manifold to achieve the higher rpm/maximum resonance near the Rossi claim of 22,000rpm for the engine. Shortening it by 1.4 inches proved almost correct in that the pipe/engine combination now operated at correct full resonance at 21,700rpm and a final 5.05hp was achieved.

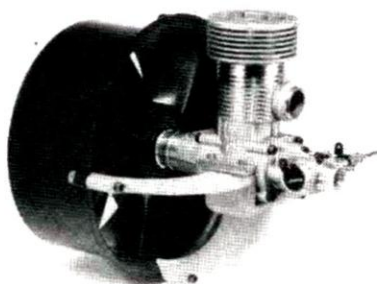
From brief tests with the Byron rotor attached, it seems likely that higher percentages of nitro than the 10 percent used here would be necessary to achieve the 20,800rpm quoted by Byron. Byron advises 20-percent-nitro fuel and a 12³/₈-inch-long Rossi pipe (plug to maximum diameter).

In the less-than-typical dyno situation, however, the rotor alone was fitted (without the matching static shroud), and the resulting "pusher" air flow (without a fuselage to direct and focus the air flow over the pipe and engine), proved inadequate for correct cooling—hence, the very brief nature of the fan test and the omission of relevant dB tests, which require at least 5 minutes running time to complete. Together, these two points

lead me to doubt that these rpm would be achieved in a "real model" situation.

SUMMARY

The Rossi combination of structural robustness and a measure of "de-tuning" places this .90 fan engine firmly in the "reliable" area of operation, but it should be possible to extract further power by using "tighter" chamber geometry or more nitro.



The Byrojet fan unit here gives from 11 to 14 pounds of thrust, depending on rpm. Note: the blades are in the pusher mode, so the carburetor faces forward and benefits from the installation of a carburetor air filter.

Unless a competitive performance ethos begins to dominate ducted-fan scale aircraft, then it seems a wiser (and less nerve-wracking) move to operate these already massively powerful engines in their relatively mildly tuned "out-of-the-box" form. Where, however, this style of engine is to be pushed further up the performance tree, the Rossi .90 is better structurally equipped than some to withstand the increase in performance that's clearly available. Being operated in the "mild" form, this test engine was unscathed to the end. ■

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Angle Sanding

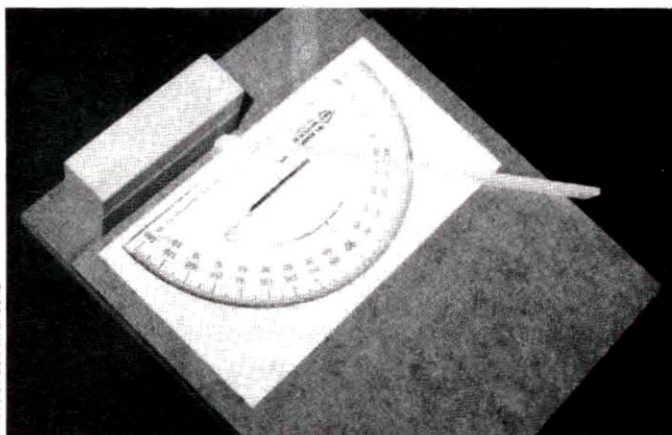
HOW TO

Made Easy

A TOOL FOR MORE
PRECISE BUILDING

by WALLACE G. KELTNER

PHOTO BY DON W. BROOKS



LAST FALL, my wife, Susan, announced that she needed a trainer aircraft. She chose the trusty Sig Kadet Senior. When the kit arrived, we were both impressed with the quality of the parts and the drawings, but we noted that there were lots of balsa sticks to be glued together. The plan's structure required that angles be sanded on one or both ends of many of the pieces. Since this was Susan's first kit, I wondered how I could simplify the task of cutting all those angles.

I thought about buying one of those fancy manual sanding devices advertised in the modeling catalogues, but the price was well over \$20 with delivery. Then I thought, "I can build the thing!" My original design had several sliding, aligning components and micrometer-type details. Despite my rocket-scientist approach, I began to develop a device that may represent the ultimate in simplicity.

The final product (shown here) has one moving part and angle control to within $1/2$ degree or better! My final cost was about 20¢—two pieces of free scrap wood, 10¢ worth of glue and 10¢ worth of photocopying!

This angle sander is very easy to build. First, scrounge the wooden parts from your scrap box. Cut the base of the alignment board out of a piece of $5/8$ - or $3/4$ -inch-thick particle board or plywood. The dimensions aren't too important—I made mine 12x14 inches. Next, cut a piece of $1/8$ - or $1/4$ -inch-thick Masonite or plywood about 2 inches shorter than the base. Mine is 12 inches square. Glue the thinner piece to the thicker one so that there's a 2-inch-wide indented "runway" across the top.

Now, borrow your best friend's nice new shiny plastic protractor. (This helps to control the cost.) Use a copy machine to make an enlarged image of the protractor (8 to 10 inches wide). Return the protractor to your best friend.

Glue the image of the protractor to the alignment board. Make sure that the base line of the protractor is parallel to the top edge of the Masonite or plywood that forms the runway.

Craft shops carry some excellent glues for de-

coupage, but if you can't borrow some, you'll add a couple of bucks to the original cost estimate.

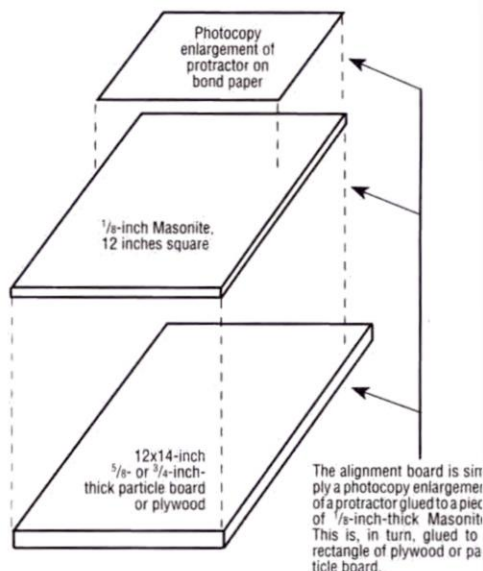
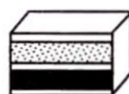
The final step is to make the sliding sanding block. I used a 6-inch-long scrap of 2x4. I simply trimmed it on my table saw so that it had sharp, square edges. Place the block on the alignment board in the runway, hold it against the Masonite or plywood, and mark it with a pencil. This line will tell you where to glue the sandpaper strip so that it doesn't contact the alignment board. You'll probably want to flip the sanding block and mark it so that you can glue more than one strip of sandpaper to it. Mine accommodates four 1-inch-wide strips of sandpaper. I use 100- and 200-grit paper and rubber cement on my sanding block (see illustrations).

Using the angle sander is as simple as building it. First, measure the angle that you want to sand. (Maybe you should have kept your best friend's protractor!) Then, place the wooden strip on the alignment board. The strip should cross both the origin of the protractor image and the desired angle on the protractor scale. Don't try to remove all the extra material at once. While holding the wood firmly against the alignment board, gently slide the sanding block back and forth. As you sand, feed the wood up against the sandpaper about $1/32$ inch at a time. You'll get the hang of it quickly.

Keep an old toothbrush handy and use it to clean the sanding dust out of the runway. (If you don't, it will accumulate and tilt the sanding block.) For small pieces of flexible balsa, hold a thin metal or plastic ruler beside the strip for rigidity.

I hope you enjoy your sander.

Sanding block (right). Note that strips of sandpaper have been attached with glue so that they won't touch the Masonite when they slide against it.



"I thought about buying one of those fancy manual sanding devices advertised in the modeling catalogues, but the price was well over \$20 with delivery. Then I thought, 'I can build the thing!'"



BASHING THE ROYAL B-17

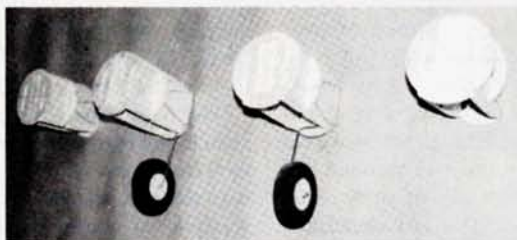
by JOE BESHAR

♦ SILENT FORTRESS ♦

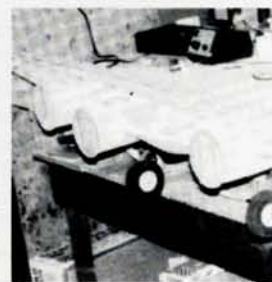
BEING ASSIGNED to B-17 aircraft during WW II while serving in the 303rd Bomb Group and 358th Squadron of the 8th Air Force was an unforgettable experience. The B-17 flying fortress—"Queenie"—safely carried us through 17 complete bombing missions. This encouraged me to build an electric-powered model of Queenie, which will always have a place in my heart.



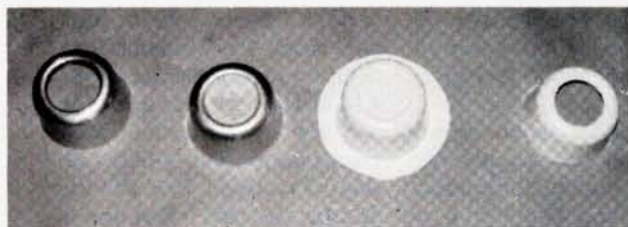
1. The wing is built light. Ribs and wing sheeting are $\frac{1}{16}$ inch thick; all the spars and the leading and trailing edges are of soft contest balsa. Here, the nacelles have been loosely fitted and aligned relative to the table top.



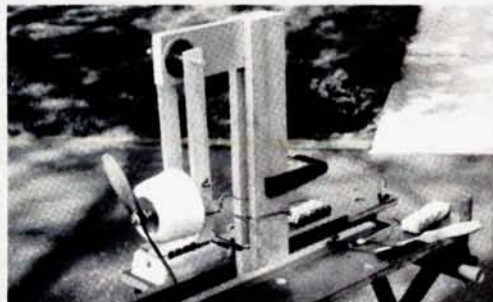
2. This shows details of the wing nacelles' structure; the only plywood is the firewall; all other structural parts are made of soft, $\frac{1}{4}$ -inch-thick contest-grade balsa. To facilitate fitting and disassembly during construction, the wing intersections are marked at the side of each nacelle.



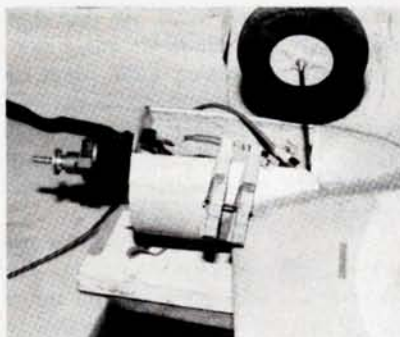
6. The nacelles are aligned and then glued to the main wing structure. Sand-filled plastic bags are hung over the trailing edges, and a couple of die blocks were hung over the center section to brace the wing even more.



7. To save weight, I vacu-formed the engine cowls out of 020-inch-thick ABS plastic, which I vacu-formed over a Royal Products® aluminum cowl. I trimmed off the excess plastic (as shown) and saved a total of 4.76 ounces (thanks to the assistance of my good friend, Don Garafalow).



11. The static thrust tester shown here was featured in the September '91 issue of *Model Airplane News*, which featured detailed plans and building instructions. I used it to test for the most efficient prop arrangement with the cowl in place. I found the Rev-Up® 10x8W prop, cropped to a diameter of 9 inches, to be the most efficient. The plane was powered by 24 Sanyo 800 AR Ni-Cd batteries in two, flat, 12-cell packs that are linked by connectors to facilitate charging. The batteries are wired in series so that each motor "sees" six cells.



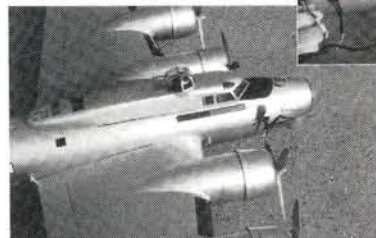
12. Fourteen-gauge wire is used throughout, and all the connections were soldered. To make a soldering aid, I drilled two clothespins to accept a piece of 16-inch-diameter piano wire. The clothespins can be slid side by side to grasp two wires at any desired spacing for soldering. Without a clamping tool of this kind, you need three hands.

8. The tail feathers were built out of $\frac{1}{16}$ -inch-thick, light, contest-balsa sheet. After building the tail feathers, I sanded the sheeting to a thickness of approximately $\frac{1}{32}$ inch. All the hinges used in the model are "easy-hinge" type.





After a successful flight, a happy Joe Beshar admires his "bashed" B-17.



Detail of the front of the "Flying Fortress."

The thought of using four electric motors was not only exciting, but it was also an interesting challenge.

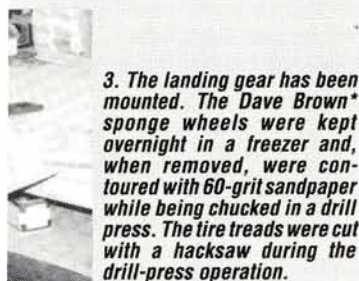
My plan was to build a model that would have a wingspan of just over 6 feet. After considerable research, which included a close look at Tom Cook's glow-powered model shown in the January '73 issue of

The cockpit section has been removed so that the batteries can be charged.

Flying Models, I chose the Royal Products* 1/16-scale B-17 kit, which has a wingspan of 78 inches and was designed for glow power. Royal Products also offers accessories such as canopies, cowls and

SPECIFICATIONS

Type: Scale electric B-17 (3/4 inch = 1 foot)
Manufacturer: Royal Products Corp.
Wingspan: 78 inches
Length: 55 inches
Wing area: 806 square inches
Wing loading: 24.3 ounces per square foot
Power: four geared Astro Flight 035 cobalt motors substituted for .20 glow engines; Jomar SM4 speed controller; 24 800mAh Sanyo AR batteries
Propellers: Rev-Up 10x8 props cropped to a 9-inch diameter
Construction: Balsa and ply



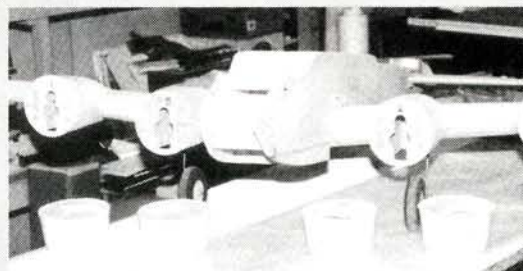
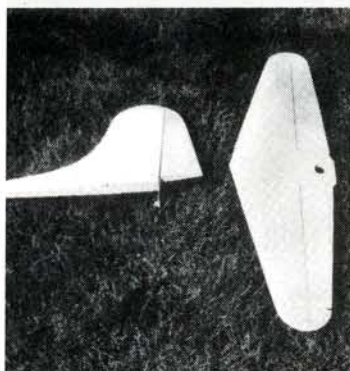
3. The landing gear has been mounted. The Dave Brown* sponge wheels were kept overnight in a freezer and, when removed, were contoured with 60-grit sandpaper while being chucked in a drill press. The tire treads were cut with a hacksaw during the drill-press operation.



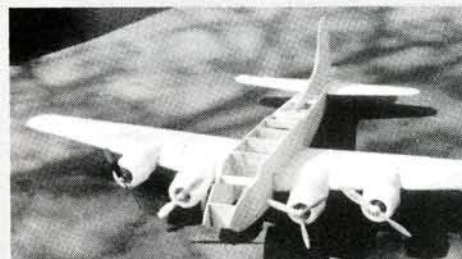
4. The wing sheeting was edge-glued with CA, assembled on a plastic sheet and weighted down with die blocks, as shown. The die blocks are absolutely flat, so they ensure that the sheets will be perfectly aligned. You'll find these die blocks in any machine shop.



5. Die blocks hold the sheeting while it's being attached to the wing. While the glue is setting, masking tape holds the sheeting to the wing frame at the leading and trailing edges.



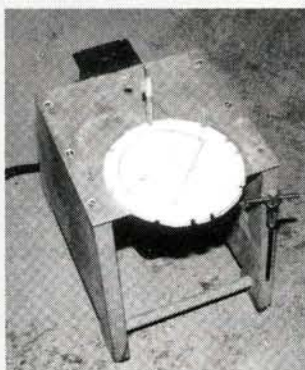
9. The profile fuselage and wing have been assembled. On the table in the foreground are four cowls. For structural strength, ordinary 1/2-inch insulated-foam siding board was fitted and glued to the rear of each one.



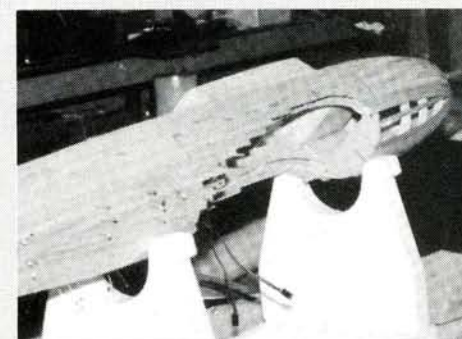
10. Each of the four cowls is shown with a different prop configuration. The efficiency of these props was tested in static bench tests.



13. In phase one, the front of the fuselage was covered with MonoKote* to minimize air resistance during flight. The rest of the fuselage was left open, as shown.



14. After successfully completing phase one and flight-testing the plane, I built and detailed the scale fuselage (phase two). To start, I cut out the formers, as shown. A powered hacksaw makes center and outside cutting easy to do. If you're interested in building one of these hacksaws, I'll be happy to send you a copy of the detailed plans and instructions for \$2 (enclose a self-addressed stamped envelope). My address is at the end of the article.



15. I planked the fuselage with soft, light, contest-grade balsa. I used Pica* Gluit adhesive, which I found ideal for this job.

ROYAL B-17

decals, which are listed separately in the price list.

To convert the kit to electric power, I had to modify the construction so that the final weight would result in the lowest possible wing loading. Instead of using plywood in all the usual places, I therefore substituted, for the most part, thin balsa sheet, using it for wing ribs, formers, planking, etc.

I planned to complete the project in two phases: first, the wing and tail feathers, but the box-construction fuselage would be completed in profile only. This made sense because the wing nacelles carry the landing gear as well as the motors. Thus, I'd be able to test-fly the model without having to build a complicated, rounded fuselage. After test-flying the prototype, I planned to build the actual B-17 fuselage. On the other hand, if I wasn't successful, I would have avoided spending time on building the proper fuselage and would shed fewer tears during its burial!

Since a picture is worth a thousand words, I'll show the construction of the electric B-17 in pictures.

**Here are the addresses that are pertinent to this article:*

Royal Products Corp., 790 West Tennessee Ave., Denver, CO 80223.

Astro Flight Inc., 13311 Beach Ave., Marina Del Rey, CA 90292.

FLIGHT PERFORMANCE

Powered by four geared, 035 Astro Flight cobalt motors running on 24 800mAh cells, the electric Royal Products B-17 has successfully flown off grass and paved flying fields.

• Takeoff and landing

The B-17 is a tail-dragger, so I was very careful to keep the tail down with up-elevator during its first flight. Advancing the Jomar SM4 electronic speed controller to full rpm resulted in a takeoff in less than 10 feet and a steep climb angle of nearly 40 degrees! Amazingly, it didn't stall during these first, precarious moments, and I was able to level it off into a stable flight. The plane has enough power. Some down-elevator and less than full throttle are needed for sustained level flight. With the proportional speed controller, landing approaches were easy.

• High-speed performance

At full power, the B-17 flies stably with a docile performance that's reminiscent of the full-size aircraft.

• Low-speed performance

The B-17, with its 24.8 ounces per square foot wing loading, proved reasonably responsive at low speeds. When flying at low speeds, the nose must be kept low to prevent a stall.

• Aerobatics

As a heavy bomber, the B-17 was never intended for aerobatics. With a little over 40 watts per pound power loading, the model delivers realistic scale performance. Flight times averaged 3 to 4 minutes. The resonance of the electric motors also reminds one of the sound of the full-size version.

Dave Brown Products, 4560 Layhigh Rd., Hamilton, OH 45013.

Rev-Up; distributed by Progress Mfg. Co., P.O. Box 1306, Manhattan, KS 66502.

MonoKote/Great Planes Model Distributors, P.O.

Box 9021, Champaign, IL 61826.

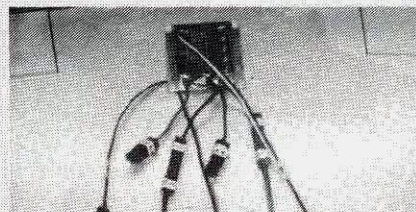
Pica Enterprises Inc., 2657 N.E. 188 St., Miami, FL 33180.

Coverite, 420 Babylon Rd., Horsham, PA 19044.

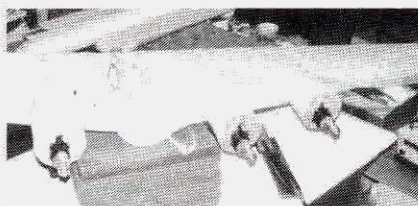
Joe Beshar, 190 Merritt Dr., Oradell, NJ 07549. ■



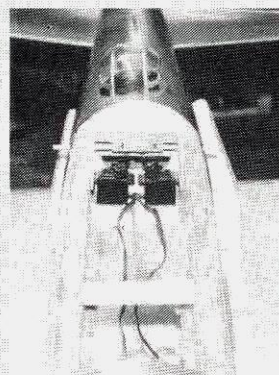
16. After completing the planking, I sanded the skin to a thickness of $1/16$ inch or less. I mounted the tail feathers with a vee-member, as shown, and I put an elastic band across the bottom to hold the rudder in place for proper alignment. This helped me to fit the dorsal fin. The formed-plastic cockpit enclosures shown here are from Royal Products.



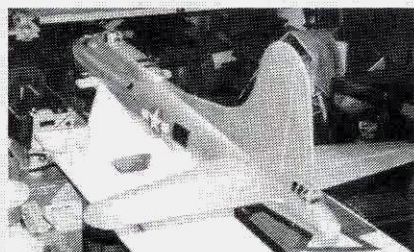
19. A close-up of the SM4 Jomar[®] speed controller, which is mounted on the top of the wing, supported with $3/16$ -inch lengths of tubing and held with 4-40 plastic screws. Jomar's literature indicates a 21-cell limit for this controller, but it handles the 24 Ni-Cd cells perfectly.



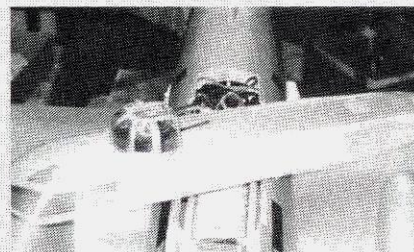
17. I covered the balsa sheet with Coverite's[®] Clear Mica Film, which is one of the lightest heat-shrink coverings available. It can be applied over compound curves quite readily using Coverite's Balsarite adhesives in those areas where adhesion is required. A piece of the Mica Film to be marked for the cutouts at the nacelles is shown lying on the wing. The nacelles were covered separately after the main wing had been covered.



20. See the rudder and elevator servos in the rear part of the center fuselage bay. Note the ball turret at the bottom of the fuselage.



18. Here's the finished wing assembly with the three-blade props mounted. Note the insignia, the leading-edge boots and the flap outlines.



21. This top view of the battery compartment shows the top 12-cell Ni-Cd pack. A rubber band holds the upper trap-door section of the fuselage down. The battery box is held to the fuselage bottom with Velcro[®], so it can be removed easily. To look inside the top of the fuselage, lift it and twist it, and then return it to its correct position.



AIRFOIL SELEC

PART 1 EXPLAINED airfoil plots in detail and indicated that airfoil selection could be achieved by comparing the lift coefficient (C_L), drag coefficient (C_D), pitching moments (C_M) and other airfoil characteristics directly.

The final selection of an airfoil for your design depends on the design and on how you want the airfoil to perform, i.e., its "mission profile."

For a sailplane, high lift, low drag and pitching moment at low R_n s is the choice. For an aerobatic model, a symmetrical section with low C_M and the capacity to operate both upright or inverted is desirable, along with a sharp stall for spins and snap rolls and as high a C_L max as can be found. For a sport model, an airfoil like E197 is ideal. It has high C_L max, low drag and a moderate pitching moment. The stall is gentle. Note that the so-called "flat bottom" airfoils like the Clark Y (popular for sport models) are, in fact, moderately cambered airfoils.

FORMULAS

Now for those "dreaded" formulas. Don't be alarmed; they're simple arithmetic with just a touch of algebra. Their solutions are easily computed on a hand calculator that has "square" and "square root" buttons.

These formulas have been modified for simplicity, and to reflect model airplane values of speed in mph, areas in square inches, chords in inches, pitching moments in inch/ounces and weight, lift and drag in ounces.

Formula 1: Reynolds Number (R_n)

$$R_n = \text{speed (mph)} \times \text{chord (inches)} \times K$$

(K at sea level is 780; at 5,000 ft. is 690; and at 10,000 ft. is 610)

Formula 2: Aspect Ratio (AR)

$$AR = \frac{\text{span (inches)}^2}{\text{wing area (square inches)}}$$

Formula 3: Taper Ratio (λ —Lambda)

$$\text{Taper ratio} = \frac{\text{tip chord (inches)}}{\text{root chord (inches)}}$$

(A straight wing has a taper ratio of 1.)

Mean aerodynamic chord (MAC)

Figure 13 provides a graphic method for locating the MAC and its $1/4$ chord point. The MAC is defined as "that chord representative of the wing as a whole and about which the lift, drag and pitching moment forces can be considered to act."

Formula 4: Total of Section and Induced Angle of Attack

$$\alpha (\text{alpha}) = \alpha_0 + \left[\frac{(18.24 \times C_L) \times (1 + \tau)}{AR} \right]$$

where α = total of section angle of attack and induced angle of attack

α_0 = section angle of attack from airfoil plot

C_L = lift coefficient at section angle of attack from airfoil plot

AR = aspect ratio

τ (tau) = planform adjustment factors (Figures 3 and 4 of Part 1)

Formula 5: Total of Profile (section) and Induced Drag Coefficients

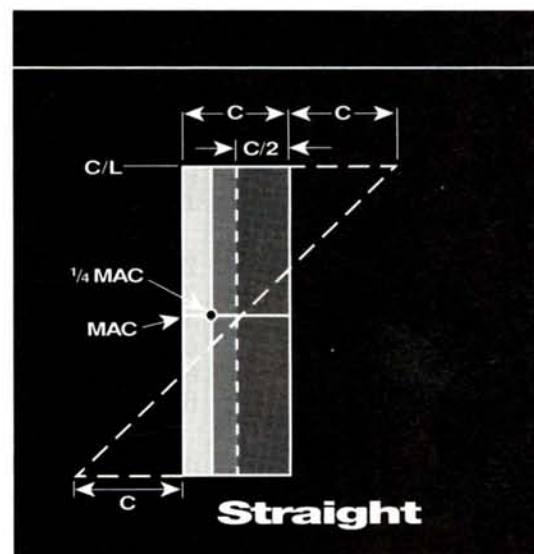
$$C_D = C_{D0} + \left[\frac{(0.318 C_L^2) \times (1 + \delta)}{AR} \right]$$

where C_D = total of profile and induced drag coefficients

C_{D0} = section profile drag coefficient at C_L chosen from airfoil plot

C_L^2 = lift coefficient chosen "squared"

AR = aspect ratio



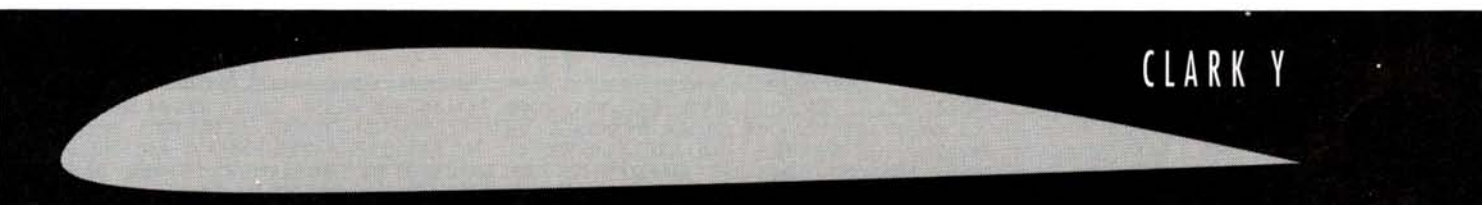
δ (delta) = planform adjustment factor (Figures 3 and 4 in Part 1)

COEFFICIENT CONVERSIONS

Up to this point, coefficients have had only abstract values. To convert these to meaningful figures, we'll use the six variables mentioned in Part 1 in these formulas.

Formula 6: Lift (or Weight)

$$\text{Lift (or weight)} = \frac{C_L \sigma V^2 S}{3519}$$



FORMATION, PART 2

by ANDY LENNON

If you want to determine the lift coefficient needed for a given air speed and weight:

Formula 7: Lift Coefficient Required

$$C_L = \frac{\text{lift} \times 3519}{\sigma V^2 S}$$

Formula 10: Pitching Moment

$$\text{Pitching moment} = \frac{C_M \sigma V^2 S_C}{3519}$$

Where in formulas 6, 7, 8, 9 and 10:

C_L = lift coefficient (formula 7)

angle of attack of 7 degrees, plus the 2 degrees negative, α_0 is 9 degrees. Apply Formula 4 to obtain α . Divide C_L 1.00 by α to obtain C_L per degree.

B: Angle of attack (or incidence) for level flight. C_L required divided by C_L per degree of angle of attack.

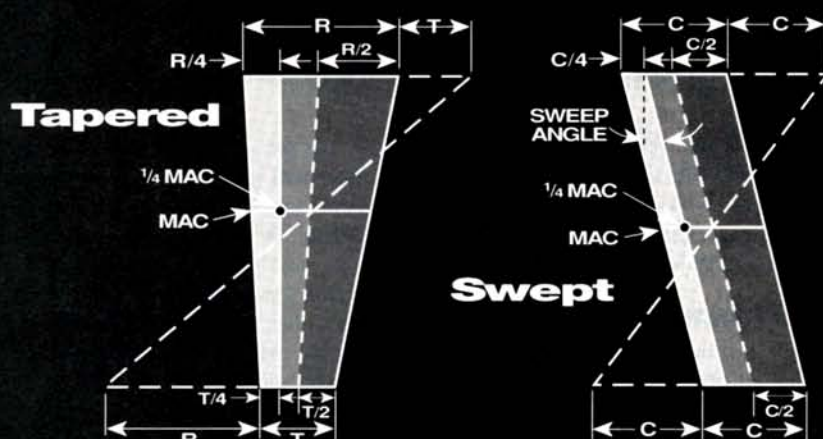
Knowing wing area, weight and cruising speed, calculate the C_L needed as in Formula 7. Divide this C_L by C_L per degree as above to obtain lift spectrum. Deduct any negative angle of attack to zero lift.

C: Stall angle of attack adjusted for AR and plan.

Adjust the stall angle of attack for AR and planform as in Formula 4. Deduct any negative angle of attack to zero lift to obtain positive value of stall angle of attack.

Good luck with your design. ■

GRAPHIC METHOD FOR LOCATING THE MEAN AERODYNAMIC CHORD (MAC).



If you want to know the model's speed at a given lift coefficient and weight:

Formula 8: Model Speed

$$V = \sqrt{\frac{\text{lift} \times 3519}{\sigma \times C_L \times S}}$$

Formula 9: Total profile and Induced Wing Drag.

$$\text{Total drag} = \frac{C_D \sigma V^2 S}{3519}$$

C_D = total drag coefficient (formula 5)

V^2 = speed in mph squared

S = wing area in square inches

C = mean aerodynamic chord in inches (see Figure 13)

C_M = pitching moment about the $1/4$ MAC at the calculated C_L in inch/ounces

σ (sigma) = density of air (sea level, 1.00; 5,000 feet, 0.8616; 10,000 feet, 0.7384)

SPECIAL PROCEDURES

A: Lift coefficient per degree of angle of attack adjusted for AR and planform.

Refer to Figure 1, Part 1 E197. At C_L 1.00 and

REFERENCES

Airfoil Design and Data by Dr. Richard Eppler*
Profilpolaren für den Modellflug by Dr. Dieter Althaus*
Airfoils at Low Speeds (Soartech #8) by Michael Selig, John Donovan and David Fraser**
Model Aircraft Aerodynamics by Martin Simon***

*Springer-Verlag, New York Inc.
 P.O. Box 19386
 Newark, NJ 07195-9386

**H.A. Stokely
 1504 North Horseshoe Cir.
 Virginia Beach, VA 23451

***Zenith Books
 P.O. Box 1/MN121
 Osceola, WI 54020

FORMULAS FOR FLIGHT

FLOATING AROUND

JOHN SULLIVAN



OGOPOGO

THIS MONTH, I have a source of scale documentation, some video news and some notable models to share with you.

THE ULTIMATE FLOATER

David Titterton of Victoria, B.C., Canada, sent a photo of his Goldberg* Ultimate on 36-inch Sullivan* floats. The Ultimate is powered by an early O.S.* 90 4-stroke with a C.H. Electronics* ignition. The covering is Solartex with an automotive enamel finish.

David reports that the Ultimate handles the floats well, although the model is considerably more sedate than when it's equipped with wheels. At first, David tried



David Titterton's float-equipped Ultimate Bipe stands ready at the Lake Cowichan Float Fly in British Columbia.



Stan Wilson brought his Proctor Antic Bipe (on three-point, old-timer floats) to the Ogoopogo meet. The fine sand beaches are perfect for launch and retrieval.

to get by with one water rudder, but the Ultimate's large side and air-rudder areas caused it to behave like a luffing sailboat. He has now converted the bipe to twin water rudders, and all is well.

THE FLOATING MAILBAG

I received a complimentary video from Dick Hansen of Hansen Scale Aviation Videos*. This example is the 11th in Dick's series, and it features the '91 Northwest Seaplane Championships, the '91 NW Scalemaster's meet, a full-scale aerodrome '92 preview, and visits to Dan Parsons' shop and the Fox manufacturing plant. For

one such as me—so thoroughly immersed (pun intended) in float flying—it was an eye opener to see what else was going on in modeling. This is the third Hansen video I've seen, and I've enjoyed all of them.

Leonard Opdycke, of World War I Aeroplanes Inc.*, sent in a couple of issues of his scale magazines that featured the Savoia S.65 and the Piaggio PC-7. Apart from my interest in the Schneider racers, I was amazed at the scale detail and research throughout the magazines. If any of you are modeling the WW I era, it would be worth your while to write and ask for the back-

(Continued on page 64)



Mark Wald designed and built this 132-inch flying boat, which he christened "Salty." This great flying seaplane weighs 30 pounds and is powered by a Quadra 50.



Ted Russel displays his twin .60 2-stroke-powered, 9-foot twin Otter at Ogoopogo. The scratch-built ship is white with blue and red trim.

FLOATING AROUND



Sorry, no name was provided for the owner of this twin 4-stroke See Bee. The Ogo-pogo meet is held at the Crystal Waters Resort on Crystal Lake near Vernon, British Columbia, Canada.



A helper prepares to release Mike Stippon's huge 12-foot, 60-pound PBV. Twin Super Tigre 2500s power this impressive white, red and blue amphibian.



The variety of giant floatplanes at Ogo-pogo was exceptional. This Fairchild Husky spanned 108 inches, weighed 33 pounds and was powered by a 3.5 Kawasaki.



Ted Russel's fantastic 10-foot "short" Imperial floats proudly at Ogo-pogo. This scratch-built giant uses 13 servos, weighs 44 pounds and uses four Enya .80 4-strokes.



Walter Moller is a prolific builder. In addition to his Dornier, and his Blum & Voss bomber, he brought this 71-inch-span, 120 4-stroke-powered Arado 196 to Ogo-pogo.

issues listing. You'll need a magnifying glass to read the list, but the scope of coverage is incredible and well worth the effort.

BACK TO OGOPOGO

As promised, I'm delighted to share more of the fantastic seaplanes that showed up at the Ogo-pogo '91 meet, held at Crystal Lake near Vernon, B.C., Canada. Special thanks go out to Walter Moller, Ted Russel and Ed Westwood for providing the photos you see here. I was fortunate to receive a videotape of the meet from Ed Westwood. As you might expect, the planes are very exciting on the water and in the air. Moller's Donier 217 K.P. was equipped with smoke so thick you could almost smell the kerosene coming out of the TV! Ted Russel's short Imperial was so big that you could actually hear the spray blister splashing back on the water as the four-engine giant sped by on a step run! Anyway, enjoy the photos. See you next time.

*Here are the addresses of the companies mentioned in this article:
Carl Goldberg Models, 4734 West Chicago Ave., Chicago, IL 60651.
John Sullivan Floatplane Products, 1421 Second St., Calistoga, CA 94515.
O.S. Engines; distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.
C.H. Electronics, P.O. Box 1732, Riverton, WY 82501.
Hansen Scale Videos, 10807 S.E. Stacy Court, Portland, OR 97266.
World War I Aeroplanes, 15 Crescent Rd., Poughkeepsie, NY 12601. ■

by JIM
SIMPSON



Author poses with Zero after snowstorm.

HERE'S A good-looking, low-wing tail-dragger that flies like a sport plane. No—*better than* many sport planes! The Midwest* Zero's performance is definitely worth the effort needed to build the kit. Let me tell you about both, but let's put it in perspective and start from the beginning.

I've been building R/C models for other people for 30 years, so naturally I agreed to do this kit review when Tom Atwood men-

tioned the need. I asked him to send one of the posters of the Zero that are offered by *Model Airplane News*, and I continued to work on then-current projects.

The day of arrival of the Zero kit found me finishing a 2-meter sailplane kit manufactured on the West Coast. I anxiously opened the Zero box and—voilà! The typically executed Midwest Products product was there before my eyes.

THE KIT

The thing I most appreciate about Midwest Products kits is the wood quality. As usual, it was clear,

light and correctly cut. The next eye-grabbers were a formed ABS cowl and a canopy with the framework outline molded in. The two-piece cowl will be easy to paint, because all models of the Zero have black cowls. The canopy frame can be painted inside (which avoids any fuelproofing problems), and if you're careful, no masking tape will be needed. The decals are "sticky back," and details include wing-tank fuel caps and even arrows with Japanese script.

Other Midwest standards I've come to expect are accurate, uncluttered, printed, easy-to-read plans and an accompanying construction manual featuring step-by-step instructions illustrated with clear, simple line drawings. The construction manual begins with a



M I D W E S T

ZERO

RISING-SUN FUN



COLOR PHOTOS BY DAN PARSONS

ONCE YOU GET USED TO THE ZERO, YOU CAN MOVE THE CG BACK A LITTLE AT A TIME AND GET SOME SPECTACULAR PERFORMANCE.

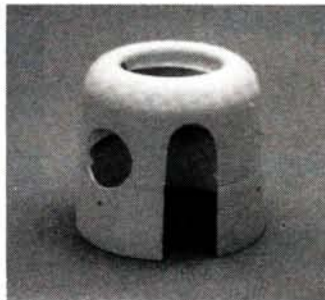
list of the kit's contents (like a bill of materials) that includes a description of what each piece is for. It also includes two pages of illustrations of the die-cut sheets. This is followed by a checklist (also illustrated) of the tools and materials you'll need. If you've never seen one of these construction manuals, I assure you it will be worth the effort to take a look.

The hardware package was also of high quality. I noticed the pre-formed wire landing-gear struts had the correct angles for the forward-swept look.

CONSTRUCTION

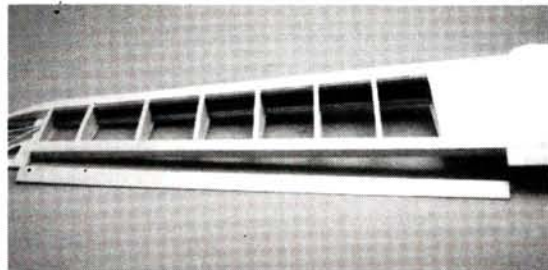
Three days after beginning construction, it was ready to cover (only eight or nine hours of work a day, and while working on two other planes as well). Wing construction is enhanced with a die-cut dihedral gauge, die-cut ribs with alignment tabs attached and a building-jig strip to help ensure alignment while finishing the bottom of each wing panel. In my opinion, there are three things that are really difficult for most modelers. Carving wing tips and leading edges are two; the other is aileron linkage. Model designer Tom Herr limited the wing-tip problem to contouring the top and bottom wing-tip blocks to follow the curve of the leading-edge planking. This worked out well. On the other hand, I did find that the aileron linkage will work better if the control horns

are slightly recessed into the wing trailing edge (no big deal). Unfortunately, there's no detail on how to carve the shape of the wing



The Zero's cowl is easy to trim. I cut these holes to provide clearance for the cylinder head and muffler.

leading edge. I carved off the top and bottom corners with a knife, shaped it with a razor plane, rough-



The Zero's wing is tapered all around and is a cinch to build.

sanded with a long, narrow block (at least $\frac{3}{4} \times 3 \times 11$ inches) spanwise, and finish-sanded by hand.

FUSELAGE

Assembling the fuselage is a real treat, because everything fits so well. The tabs exactly matched the grooves everywhere. I did wonder, however why the slot for the tail-wheel bracket wasn't die-cut. Your biggest challenge will be planking the top rear of the fuselage with $\frac{1}{8} \times \frac{1}{4}$ -inch balsa strips. My advice is to study the draw-

ing detail and take your time.

Let's talk about the cowl. If you have a bandsaw and a Dremel tool, use them to save time and effort. There's a potential problem hiding in the alignment stage. I mounted my engine on its side so the exhaust would be below the wing. To ensure correct alignment (as specified in the manual), I built a balsa jig and bolted it to the prop shaft after slipping the cowl onto the nose of the plane. It just fits inside the front of the cowl and ensures adequate prop clearance. This saved lots of time and gave perfect results.

TAIL FEATHERS AND COVERING

I finished the tail by simply edge-

gluing the balsa together, jig-sawing the outline, rounding the edges and setting it all aside to await covering. The kit illustrates the all-gray version with a black cowl, but I wanted something more colorful. I wasn't able to get the proper colors in any iron-on plastic to match the poster version from *Model Airplane News*, so I discussed my dilemma with Stan Johnson, owner of the local Hobbies N' Stuff and a great modeler. He showed me the Squadron/Signal Publications Booklet No. 59 on the A6M Zero in action. Wow! Ten different profiles in color! The orange, black and white trainer version caught my eye, and now you see the result. There really were orange Japanese Zeros!

I covered the parts with

SPECIFICATIONS

Model name: Zero
Manufacturer: Midwest Products Co., Inc.
Type: Easy-to-build warbird sport plane
List price: \$119.95
Wingspan: 60 inches
Wing area: 552 square-inches
Weight: 5 to 5½ pounds (review model: 4 pounds, 15 ounces)
Wing loading: 21 ounces per square foot
Length: 40 inches (not including prop or spinner)
Engine used: O.S. 40 FSR
Recommended: 35 to 45 2-stroke 40 to 50 4-stroke
No. of channels req'd: 4 (aileron, elevator, throttle and rudder)
Radio used: Kraft KP-7C
Prop used: Zinger 11x6
Airfoil type: Symmetrical
Washout: No
Wing construction: Conventional built-up
Kit construction: Conventional interlocking lite-ply fuselage and sheet-balsa tail
Optional accessories used: None

Features: this kit is a well-designed, 40-size sport plane that's made to look like the famous WW II Japanese Zero. True wings are ensured with rib tabs and jig strips. The interlocking lite-ply fuselage is a snap to build, and the tail group is simply sheet balsa with elevators joined by music wire. The formed plastic cowl and canopy make finishing easy.

Hits

- Well-illustrated construction manual, nicely formed ABS cowl, detailed molded canopy, high-quality balsa.
- It flies very well!

Misses

- The kit could use a jig fixture to align the cowl.
- The construction manual should include further detail on how to carve the shape of the leading edges.



The Zero's fuselage is a lite-ply frame topped with balsa sheet and planking. It's strong, light, true and easy.

FLIGHT PERFORMANCE

Our first test flights were done in what (for New Mexico) would be impossible conditions: that's one day after a snowstorm, with the temperature below freezing and wind at 10 to 15mph! Why? Because it was ready to fly, that's why.

• Takeoff and landing

It had been a long time since I last flew a tail-dragger, but, like bicycling, you never forget how. It took us a while and lots of help to get the engine running and adjusted, then Alan Granite carried the Zero to the only patch of runway not covered in snow, and set it down heading nearly into the wind. I advanced the throttle and fed in a small amount of right rudder command and was impressed with the acceleration. A little back pressure on the elevator stick, and the Zero finished a nearly perfect takeoff and began a right climbing turn. I wanted to shout "Whoopee," but the cold wind stifled it.



The first landing came too soon. The engine died lean at altitude about midway into a tank of fuel. I made a very long, flat glide to final approach, but I was carrying more air speed than necessary and landing crosswind, so one bounce and then it settled in for a short rollout in the snow.

The second landing came after a full flight that included some slow-speed flight. I now knew it didn't show a tendency to tip-stall. In a long, slow approach, I eased back the stick at 3 feet altitude for a real "grease job." Dan Parsons thought it was a nice landing, and believe me, he knows landings!

• High-Speed Performance

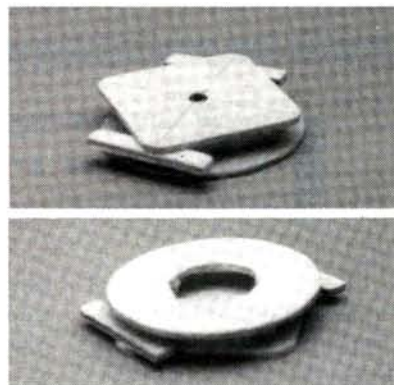
The Zero is quick! Our runway is over a mile above sea level. The Zero as test-flown weighed less than 5 pounds, which gives less than 1 pound per 100 square inches wing loading. (This is a handy rule of thumb for good-flying, propeller-driven aircraft.) The 11x6 prop on the O.S. 40 FSR is the same power package I fly on my Sig Kadet Sr. The net result is better than any of the "Stiks" and as good as pattern ships like the "Kaos." Full-throttle loops and rolls are straight and smooth. If I wanted more speed, I'd use a 9x7 or an 8x8 prop.

• Low-Speed Performance

Slow flight is a whole new field of fun and very much appreciated with a plane like the Zero. As test-flown, the balance point with an empty tank is exactly where the plans specify, and with control throws as specified on the plans, the Zero is very stable and difficult to stall. I had the specified control throws set on my transmitter in low rates, so it wasn't long before I switched to high rates (50 percent more throw) for some hot-dogging. Even with the increased elevator throw, it was hard to stall the Zero, and when stalled, it just dropped its nose and flew on out. I suspect that if the balance point was about 1/2 to 1 inch aft, it would snap-roll out of a stall. Hmmmmm.

• Aerobatics

With the center of gravity and control throws as shown on the plans, the Zero is capable of most aerobatic maneuvers. It tracks through loops without the need for correction, and rolls are very axial. Inverted flight requires very little down-elevator for level flight. The Zero isn't a beginner's airplane, but if you can fly ailerons, you can fly it. Once you get used to the Zero, you can move the CG back a little at a time and get some spectacular performance. The snap rolls and spins are truly outstanding. Armando Lewin, a local modeler who was also present and helped with the first test-flights, said that he was most impressed with the long slow glides after the engine had quit. Finally, the really beautiful tapered wing with round wingtips contributes considerable lateral stability and eliminates worry about the premature onset of stalls. We saw no tendency for the plane to snap out of full-deflection, full-throttle pylon turns. In summary, the Zero is fun to fly and that's what it's all about, isn't it?



Top: the cowl-alignment jig is made out of scrap balsa and can be bolted onto the prop shaft. The round base fits inside the cowl while the parallel crosspieces hold the cowl in position. The square piece ensures prop clearance.

Above: Rear view of the cowl-alignment jig. The large hole provides clearance for the engine crankshaft housing.

MonoKote before final assembly, then followed the manual with one exception: Wilhold Glues' R/C 56 glue (available at any hobby shop). This stuff glued the plastic canopy right on the MonoKote and stuck the MonoKote-covered landing-gear fairings to the music-wire struts so they wouldn't rotate in flight.

Radio installation went exactly as the manual outlines, although I used my own servo tray. The tank installation can be tricky, because you must keep three fuel lines separate and connect them correctly. (It's especially tricky if all three fuel lines come through the same hole in the firewall, as mine do.) You've just got to be careful and use different colored tubing if you can. I was pleased to see the illustrated steps in the manual that cover control-surface travel limits (throw) and how to achieve the proper balance point. I'd like to see one more step here:

Take the time to assemble the model, turn on the radio, sit down behind the model and check that the control directions are correct and that the linkage isn't binding (especially between the aileron servo and the fuselage innards). Now, make sure the surfaces are all in neutral, and take one more look to be sure the surface alignment is straight, correct and true. No warps, OK? [Editor's note: the manufacturer comments that this kit wasn't designed for beginners, and therefore, these skills were assumed.]

Finally, I'm pleased to see the section in the manual on flying tail-dragger models. It will be helpful to you if you've never done so. And, after all is said and done, the back cover of the manual is a postpaid, fold-and-mail, product evaluation. Nice touch, Midwest. Keep up the good work!

**Here's the address of the company featured in this article:
Midwest Products Co., Inc., 400 S. Indiana St., Hobart,
IN 46342.*

CANOPY

(Continued from page 41)

assist in the trimming operation.

Attach the canopy to the front canopy bow with no. 0x1/8 inch or 3/16-inch sheet-metal screws. Space the screws symmetrically around the canopy bow about 1 inch apart.

Next, attach the hinge assembly to the canopy and frame with a no. 1 flat-head sheet-metal screw about 3/8 inch from each end of the hinge assembly. Experiment with the correct size drill bit for use with the no. 1 sheet-metal screw prior to drilling. A trim strip of aluminum will be placed over the canopy and the two screws later.

Fabricate two 1/4-inch to 1/32 inch-wide aluminum trim strips that will be used to cover the hinge on one side and provide a trim strip on the other side. These trim strips will continue to the rear of the canopy. Use no. 1 sheet metal screws about 3/16 inch long spaced about 1 inch apart. The screws will go through the aluminum trim strip, the canopy, the hinge (on one side) and into the 3/16-inch aluminum tube.

The rear canopy section isn't attached to the trim strips at this time. The trim strips will be removed and painted later. After they've been painted, they're screwed back into place and glued to the rear canopy section.

Some sort of suitable canopy latch is required. The latch shown in the photos works quite well. The latch itself is made of 1/32-inch-thick 4130 steel sheet. The bearing is a piece of nylon from an old nylon propeller. It's attached with no. 1 or no. 2 screws or 1/16-inch rivets. The shaft for the latch is a 2-56 cap screw. The airfoil-shape handle is of a piece of 1/32-inch-thick brass. The screw head is on the outside of the handle and the nut is on the inside. A large amount of solder is flowed around the handle which will form a nice, streamlined shape. Two nuts are placed on each side of the latch and soldered to the latch. A small spring holds the latch closed.

The latch engages a no. 1 sheet-metal screw that's screwed into the aluminum frame. The nylon bearing block is attached after the latch has been positioned on the engaging screw on the frame, then attached to the fuselage. The latch looks realistic and is quite reliable. The canopy can be removed from the fuselage at any time simply by removing the hinge pin.

The canopy is dismantled for painting. After painting, attach the canopy to the frame. Use a large canopy molding strip (this material is similar to split tubing and is widely available) to seal the canopy to the windshield. Use slow-cure CA to bond the molding to the rear canopy section, but don't glue it to the front windshield! A medium-size molding strip is used for the rear of the canopy. This will hide any errors and keep the canopy from scratching the paint on the fuselage. The molding strips can be painted ahead of time or masked off and painted after they've been attached to the canopy.

I use a 1/16-inch-diameter nylon cord to retain

(Continued on page 74)

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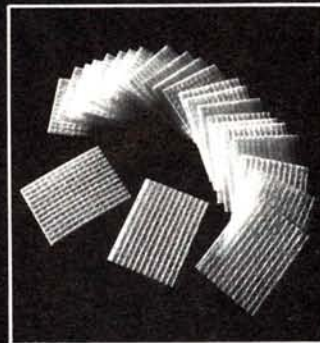
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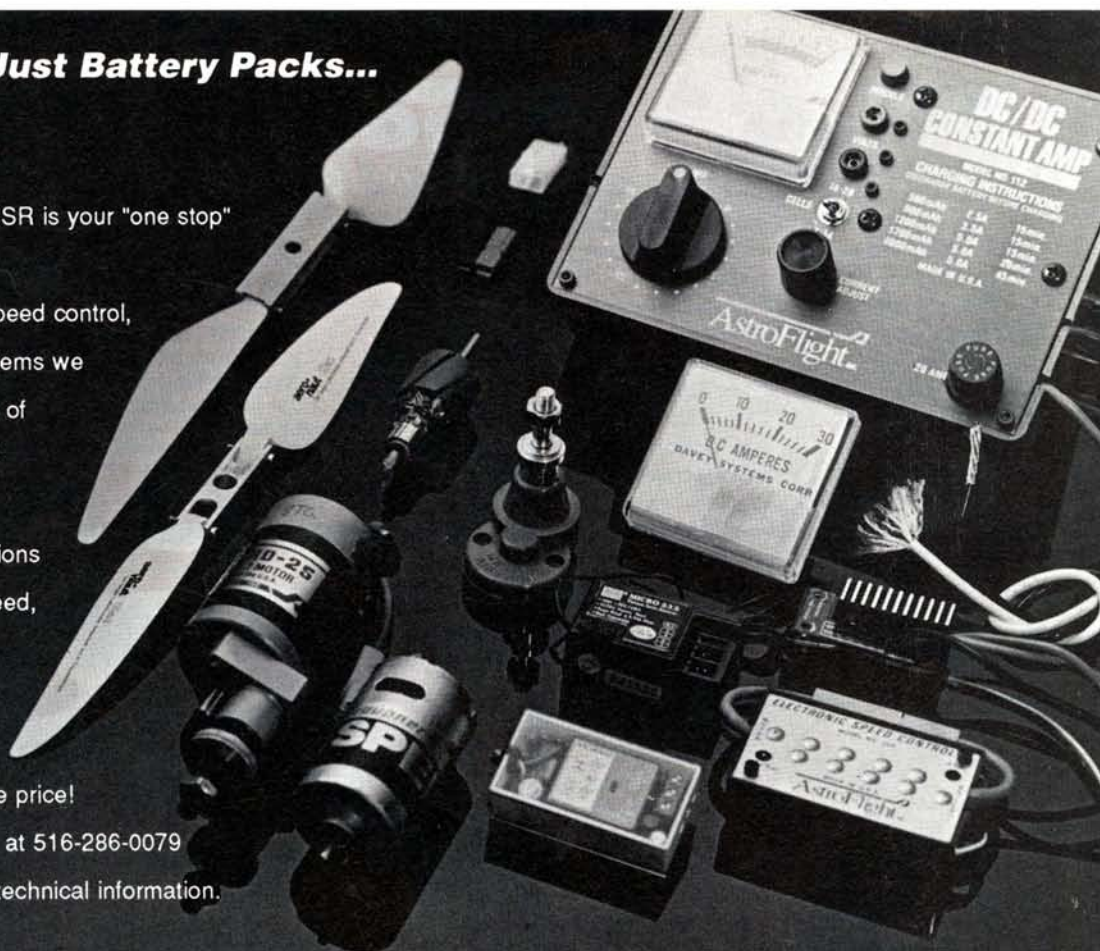
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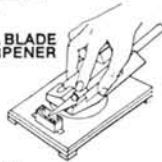
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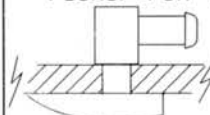
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CANOPY

(Continued from page 73)

the opened canopy in the correct position. The cord is placed into a 3/16-inch-long piece of thin aluminum tube, wrapped around the rear canopy bow and inserted back into the aluminum tube and glued in place. The other end is glued into a small solder lug that's free to rotate on a screw.

The canopy opening feature is necessary on the AL-1. All the switches and charging jacks are on the instrument panel. They're easily accessible by opening the canopy. Also, the canopy has to be opened to install the wing panels and to provide access to the R/C equipment and the gas tank.

CONCLUSION

The method used in my AL-1 aircraft canopy can be used for other similar canopy designs. Modify or redesign parts so that they meet your needs. I think you'll agree that this type of construction will greatly enhance any large model.

AIRTRAX

(Continued from page 48)

ENGINE

A stock YS*.45 with a Macs* muffler provides the power for the Airtrax .46. This engine has tons of power, but is a little heavy, and I had to

AIRTRAX

take that into consideration when I configured the radio-system layout to maintain the proper center of gravity (CG) for this model. A Du-Bro* 14-ounce tank fit nicely into the fuel tank compartment.

RADIO

A JR* 6-channel PCM radio activates the control surfaces with precision and speed. I use the 501 servos in all locations. The radio installation is easy owing to the space available. Again, it's important to think about the plane's balance when you install the radio equipment.

CONCLUSION

Whatever your mood for the day may be, the Airtrax will meet your demands. This aircraft was designed to do it all and, in short, it does. The only limitation I've found is me. Everything I try to do with the Airtrax, it does with style and flair.

It took about 12 hours (building time) from the time I started to build until the time the Airtrax was ready for its first flight—including covering and radio installation. The prefabrication of the kit is great for people like me who want to spend more time at the flying field and less time making sawdust.

**Here are the addresses of the companies mentioned in this article:*

L&R Aircraft 13645 Fisher Rd., Burton, OH 44021.
Z-Poxy; distributed by Pacer Technology, 9420 Santa Anita Ave., Rancho Cucamonga, CA 91730.

Bob Violet Models, 1373 Citrus Rd., Winter Springs, FL 32708.

Sheldon's Hobbies, 2135 Old Oakland Rd., San Jose, CA 95131.

YS; distributed by Futaba Corp. of America, 4 Studebaker, Irvine CA 92718.

Macs Products, 7935 Carlton Rd., Sacramento, CA 95826.

Du-Bro Products, 480 Bonner Rd., Wauconda, IL 60084.

JR; distributed by Hobby Dynamics Distributors, P.O. Box 3726, Champaign, IL 61826.

Top Flite Models, 2635 S. Wabash Ave., Chicago, IL 60616.

AIRWAVES

(Continued from page 10)

is 82 years young, my son Eugene and my grandson Eugene Thomas, who just turned 6 years old. He's now flying the Ultra Hots you see in the picture. We started the club in Moonachie, NJ (it's known as the Hackensack Flyers) where Art Schroeder used to come and fly with us in the late '50s. Hope you'll consider using this photo in your magazine.

EUGENE DALUSIO
Flagler Beach, FL

Eugene, thanks for your letter. One thing is for sure: modeling does keep the family together. I have fond memories of me and my father working on model airplanes in our

(Continued on page 86)

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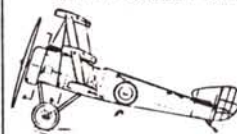
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THE SYSTEM

The Infinity is a PCM/FM radio that can also operate selected PPM/FM receivers (it's also available as a standard FM system). There are servo options to suit a variety of aircraft. The radio tested came with four 94102 standard servos, a dual-conversion Gold receiver, a PCM switch harness, a 500mAh receiver pack, a dual charger, a complete hardware package, servo trays and a detailed instruction booklet. The standard version has a list price of \$599.95, but it's available at a discount. The 600A's features include:

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- non-volatile memory (no back-up battery needed)
- "user assignable" transmitter-function switches
- dual rates on aileron, elevator and rudder
- two fully adjustable roll programs
- PPM/FM or PCM/FM operation
- programmable fail-safe in PCM mode
- plug-in transmitter battery module



PRODUCT REVIEW

AIRTRONICS INFINITY 600A

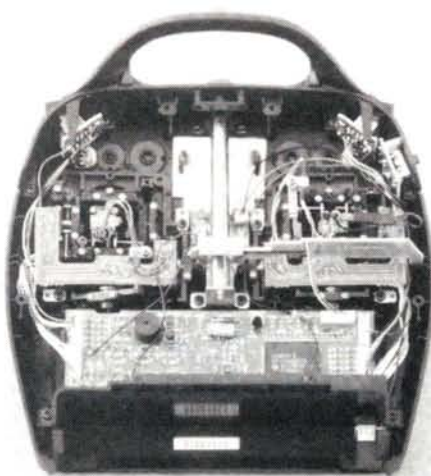
by JOHN LUPPERGER

A PROGRAMMABLE "6" WITH FOUR-MODEL MEMORY

- servo-reversing on all channels
- adjustable travel volume on all channels
- electronic centering adjustment
- fully proportional auxiliary channel
- two-aileron servo operation
- electronic differential in two-aileron-servo mode
- nine mixing options: aileron/rudder; elevator/flap; flap/elevator; flaperon; elevon; vee-tail; bi-directional for any two channels; crow for sailplanes; compensation mixing for any two channels.

The Advanced Technology Radio Control System (ATRCs) menu is similar to those of the Airtronics Vision series. Anyone who has used the ATRCS system will find it easy to operate. Six buttons control movement through the LCD program menu. The two buttons labeled "UP" and "DOWN" move you up and down through columns in the menu. The "<ENT" and "ENT>" buttons move you left and right from one column to another. The "DEC/NO" and "DEC/YES" buttons are used to answer questions "yes" or "no," or to increase/decrease values.

There are six columns; each one controls or



Transmitter features state-of-the-art components and surface-mount technology.

affects similar functions.

—**main menu group** affects the transmitter itself or an entire aircraft;

—**basic configuration** affects only a particular aircraft setup;

—**assign switch** controls the function and position of each switch;

—**surface adjustment** controls the centering and movement of each control surface;

—**mixer adjustment** controls mixing and mixer adjustments;

—**presets and dual rates** allow you to change the flight characteristics of the model.

SYSTEM SETUP

The Infinity was designed for fixed-wing aircraft, so I decided to test it in a multi-function sailplane and a glow-powered model.

The basic program setup for these aircraft is similar and was entered before I addressed each model's specific needs. Under the main menu group, each model was given a setup number in load setup: 1—sailplane; 2—power plane. Next, I turned menu protection off to allow adjustments to be made later on at the flying field. Because I didn't plan to use the radio for training, I turned off the trainer system. This automatically activates the roll program, which uses the same switch position (labeled "PROG").

Under the "basic configuration" group, I ac-

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Composite Structures Technology
BUILDING WITH TODAY'S TECHNOLOGY

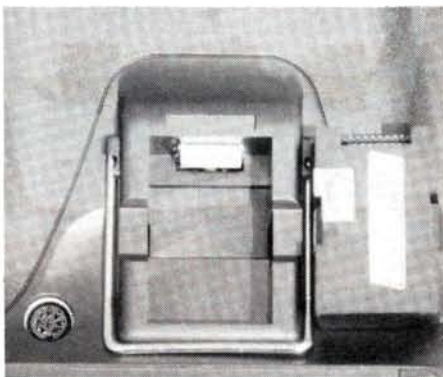
tivated the data reset to clear all other data and calibrate the auxiliary and throttle functions. I left the programmable "send fail-safe" function turned off, and this gave me "hold" fail-safe in which the receiver holds the last signal it received until the signal has been cleared.

Under the "assign switch" group, I set all the dual rates for both models to the same switch positions; ailerons on the 5-6 switch, elevator on the 3-4 switch and rudder on the 10-11 switch. At the flying field, this avoids the possibility of confusion and of inadvertently actuating the wrong function at the wrong time.

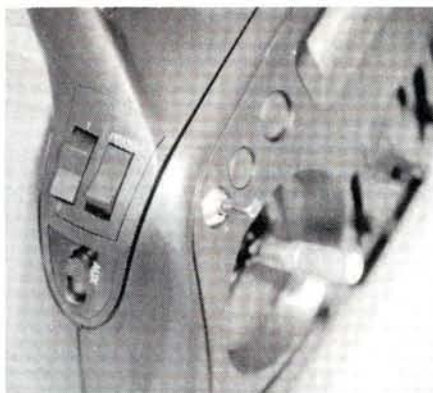
SAILPLANE SETUP

First, I set up the Airtronics Legend with the radio. This is a 4-channel, full-house, high-performance sailplane that requires multiple mixing capabilities to realize its full potential. It uses one servo for each aileron, one for elevator, one for each flap (coupled, owing to the Infinity's single-flap operation) and one for the rudder. The Infinity doesn't have as many features as the Vision 8SP (a glider radio), so creativity is required to ensure a setup that will do everything a "glider guider" wants.

The Infinity I received was from the first shipment into the country; it had the flap function on the auxiliary lever—on the left-hand side of the transmitter case. Most glider pilots use the throttle stick for flaps, so it becomes necessary to use the compensation



The module plugs into the center of the transmitter back; the trainer cord plugs into the back.



The auxiliary lever is a slide that's just below the switches on the left side of the transmitter. The rocker switches are easy to reach and actuate, and there's no danger of accidental engagement.

mixer to move the flap function to the throttle stick. There's a template for a full-house glider setup in the back of the instruction book, and I tried to follow it but found it complicated and confusing. I talked to the people at Airtronics about this, and they informed me that they've come up with a modification that will make the Infinity more versatile and allow it to be used with gliders.

The modification, which is designed to make glider set-up easier, will be standard in future shipments; it allows flap operation to be moved to the throttle stick. Airtronics has done this by adding a small plug that connects the auxiliary lever and the throttle stick. If you have an early Infinity,



The ATCRS control-panel display is to the left of the six buttons that control all programming.

Airtronics will modify your radio free of charge (you pay only for shipping).

I chose the two-aileron servo option and adjusted the amount of differential for each. To eliminate adverse yaw effect, I set it at 70 percent up and 20 percent down.

Next, I assigned the aileron/rudder coupling to the 1-2 switch and adjusted the amount of rudder throw that's available when the rudder is coupled with the ailerons.

I actuated the flap/elevator mixer and, to prevent "ballooning," I set it to give down-elevator when the flaps are operated. This mixer isn't "switch assignable" and is on all the time.

I actuated the flaperon mixer and set both ailerons "up" travel or "crow." It's very important to limit "up" so that the ailerons don't travel beyond the limits of the hinges and linkages when the plane is turning while in the crow position. There's no allowance for reverse differential, and close attention must be paid to the

aileron's total travel. I went back and reduced my aileron differential slightly to allow for more "up" during a crow final approach. You could also use the flaperon mixer to obtain full-span camber changing by reversing the ailerons so that they go down instead of up. You can have full-camber changing or crow in a setup—not both.

All the mixing described so far is of the "on all the time" variety. This means that the crow



For comparison, the airborne components are shown next to a quarter. They'll fit into most gliders.

mixing is actuated at the same time as the flaps and the flap/elevator mix. To separate these functions, you have to actuate the compensation mixer and use it on the flaps (throttle) and ailerons (auxiliary). I assigned this mixer to the 7-8 switch position. The "slave" moves a set amount when the "master" is actuated. With the flaps as the master, the ailerons-slave are given a value of 0 percent to deactivate the flaperons. This allows the flaps to work independently, but the flap/elevator mixer also ceases to function (I can't explain why).

Finally, the bi-directional mixer is used to create a flap preset for launching, best lift-to-drag, or thermalling. I did this by mixing the flaps (throttle) and the gear (unused function). I then set the flaps for the amount of travel I wanted and set the gear for 100 percent. I assigned this mixer to the 8-9 switch.

POWERED-PLANE SETUP

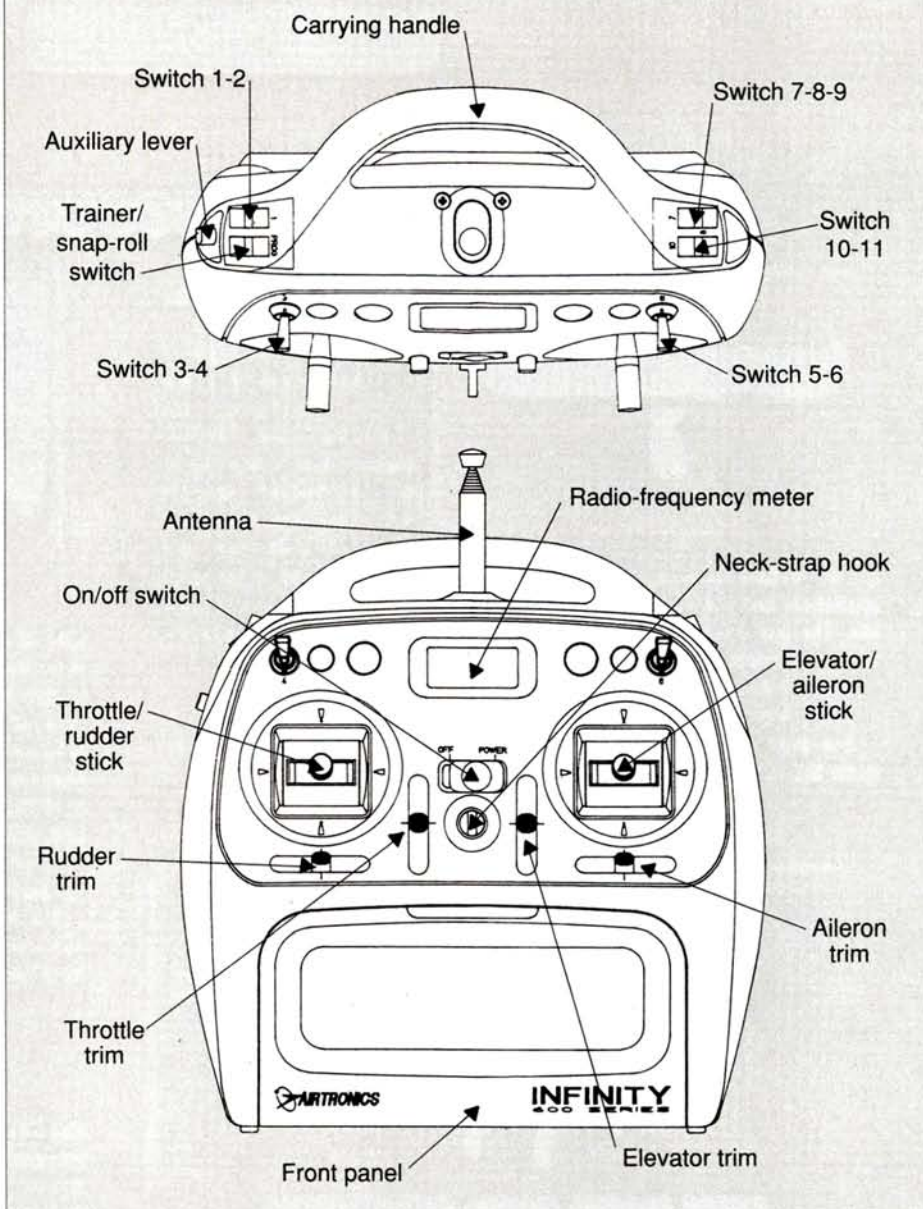
For this test, I chose the 5-channel, sport-pattern EZ Calm 25 ARF, which is quite easy to set up.

First, I had to reposition the plug in the transmitter to move the flap function from the throttle stick back to the auxiliary lever.

I then assigned the aileron/rudder coupling mixer to the 1-2 switch (same as for the glider) and adjusted the amount of rudder throw that would be available when coupled with the ailerons.

The EZ Calm offered the opportunity to use the roll-button program. This mixer allows the simultaneous movement of the ailerons, elevator and rudder: just press the spring-loaded "PROG" button on the upper left side of the transmitter. As long as the button is held, the surface deflection is maintained. Each control

TRANSMITTER CONTROL LAYOUT



surface can be adjusted individually. This allows all three surfaces to be adjusted "hard over" for a snap roll, just the ailerons for an axial roll, or just the elevator for a loop. You could also use the roll-button program for full rudder deflection during knife-edge flight, allowing you to concentrate on elevator and aileron corrections. You can control the programmed surfaces with the sticks, even while the button is being held down.

There are two roll programs. This allows the use of two setups, which could be assigned to the 7-8-9 three-position switch or any other two switches. I set up a snap roll in one program and an aileron roll in the other.

I assigned the landing gear to the 10-11 switch, which is on the opposite side from the throttle, so it's easy to actuate the retracts while decreasing throttle. In my original programming, this switch was for the rudder dual rates

that had to be repositioned. An interesting feature of the Infinity is that you can "gang up" dual rates (or mixers) on a single switch. I reassigned the rudder dual rate to the same position as the aileron dual rate.

FIELD TRIALS

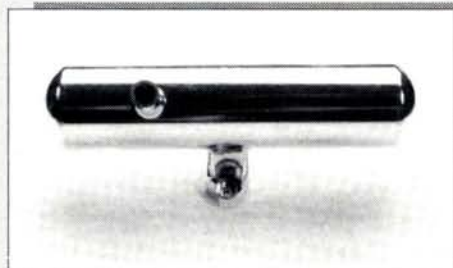
"How did it work?" I fly at two very busy flying fields where it isn't uncommon for as many as 10 models to be in the air at once. I put the radio up in the worst conditions I could find at the flying field.

First, I flew the Legend. After a couple of flights, I made small adjustments to travel volumes and dual-rate percentages, and then I decided to try out the mixers. With the easy-to-use menu, it took only a few minutes to adjust those that needed adjustment.

(Continued on page 86)

ROTARY-WING ROUNDUP

NEW HELI PRODUCTS



HOBBY DYNAMICS DISTRIBUTORS Kalt SP Muffler

Two key words in a heli flier's vocabulary are "silencing" and "performance." Kalt's new 50- to 60-size muffler delivers both. This unit is made of tempered aluminum, and

it's arc-welded for strength. The exhaust header is machined out of bar-stock aluminum and will easily accommodate any of today's side-exhaust 50s and 60s. The unit is polished to a high luster and comes with mounting hardware. It's an excellent choice for the new Kalt Baron Alpha II.

Part no. K01000688

Price: \$59.99

For more information, contact Hobby Dynamics Distributors, 4105 Fieldstone Rd., Champaign, IL 61821-8801; (217) 355-0022.



GREAT PLANES MODEL DISTRIBUTORS Kyosho Concept 30-SR

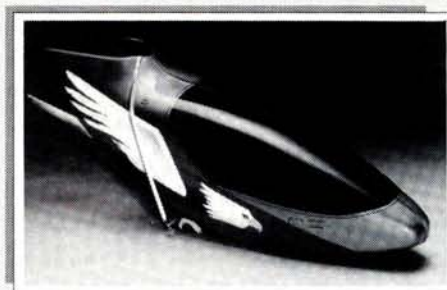
Kyosho introduces the latest version of the Concept 30—the Concept 30-SR. The SR is an upgraded version of the SX with features that fliers need for hot-dogging, Sunday sport flying and aerobatics. It has a slightly longer tail boom and main blades, all-metal pivot balls (except on the tail), a stronger, stiffer servo frame, stiffer landing gear, a stiffer rotor head, a taller main shaft and an incredible 24 degrees of useable pitch. All these add up to smoother forward flight, better autorotations, longer-lasting linkages that are easier to set up and fewer boom strikes. Specifications: main-rotor span—47.25 inches; height—14.6 inches; weight—5.5 pounds; engine—.32 to .34; radio—5-channel heli and gyro.

Part no. KYOE0285

Price: \$569.95

For more information, contact Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300, fax (217) 398-0008.

Descriptions of new products appearing on this page were derived from press releases supplied by the manufacturers and/or their advertising agencies. The information given here does not constitute an endorsement by **Model Airplane News**, nor guarantee product performance or safety.



HEL-X CORP. JR50 II Canopy

Like all of Hel-x Corp.'s vacu-formed canopies, this new canopy is made of a unique, tough plastic that readily accepts paint. The canopy is shipped with a clear, protective film on its outside surface; this can be drawn on with a permanent marker to establish painting guide lines, and it also serves as an overspray mask. Painted, assembled versions of the new canopy are also available.

Prices: \$24.95 (replacement canopy); \$99.95 and up (painted, assembled version).

For more information, contact Paul Schwartz, Hel-x Corp., 558 Highland Ave., Upper Montclair, NJ 07043; (201) 744-4962.

HEL-X CORP. X-Cell Servo Tray

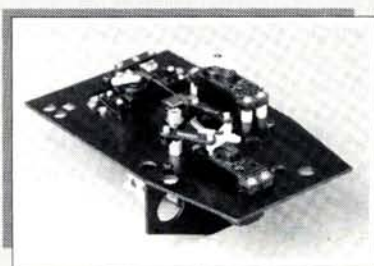
Hel-x Corp. has just announced important design refinements to its unbreakable A1001 servo tray for X-Cell 50 and 60 helicopters.

Now it offers a new, pre-cut gyro-control mounting pattern and an optional push/pull collective servo-mounting position so

that the tray can be set up with the X-Cell push/pull kit for more exact control of the collective. The A1001 tray comes complete with hardware for servo installation and assembly. Hel-x guarantees free replacement of the A1001 parts, even if they're damaged in a crash.

Price: \$49

For more information, contact Paul Schwartz, Hel-x Corp., 558 Highland Ave., Upper Montclair, NJ 07043; (201) 744-4962.





HIROBO SE Upgrade Parts

by DAVID BARON & TONY TROMBETTA

THE HIROBO® Shuttle is a cornerstone of the R/C helicopter industry. Just consider how many other helicopters and helicopter manufacturers have come and gone since the Shuttle has been in production. Past improvements in the Side frames and the rotor-head assembly demonstrate Hirobo's determination to produce a state-of-the-art flying machine. Now, with the addition of SE "Gold" after-market parts, you can customize your Shuttle so that it rivals any .30- to .40-powered helicopter that's manufactured today. No area of performance has been overlooked, and you can make your Shuttle into whatever type of high-quality, precision heli you desire.

OPTIONS

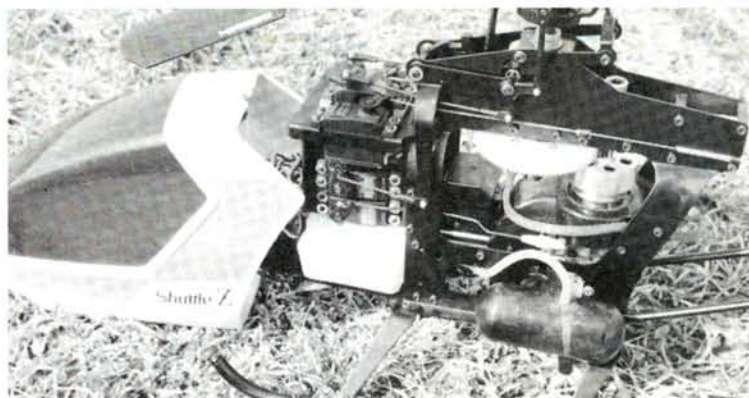
• SE Clutch Bell

The way in which the clutch engages the rotor head under power has always been one of the Shuttle's strong points; this bell makes a good thing better. This item is a light, high-quality, machined bell that offers improved cooling, less weight and better alignment than the stock unit. This is the clutch to buy when your stock unit must be replaced.

• SE Autorotation Tail-Drive Assembly

Usually, autorotations leave you with little tail-rotor-control, because it's common for the tail rotor to stop rotating during descent. This modification keeps the tail turning for as long as the rotor head is spinning. Any pilot who wants to practice "autos" with maximum control and accuracy will want this part. The drawback here is that the tail-drive assembly robs the head of power during autorotation.

BUILD THE "GOLD" SHUTTLE



The SE's metal side frames and servo assembly are shown. You can see the machined nylon main gear and the clutch from the top. Note the metal landing gear and SE muffler.

PHOTOS BY DAVID BARON & TOM ATWOOD

SE UPGRADE PARTS

• SE Radius Arm

This part does an incredible amount of work in reducing slop in the rotor head. Its primary function is to prevent the lower portion of the swashplate from moving (such movement can result in roll input when only pitch is intended, or pitch change when only roll is intended). It also helps to eliminate substantial slop in the stock plastic swashplate, which tends to become worn with use. Note: an additional ball is necessary if you're already using the SE swashplate.

• SE W-Type Washout Assembly

Precision-machined metal replaces plastic, and the result is a tighter linkage that won't flex under stress. The washout assembly lever offers a choice of two holes that are used to connect the pushrods to the arms on the stabilizer bar. The inner hole offers the same throw as the stock unit; the outer hole offers an increase in paddle travel for a more responsive head.

• SE Symmetrical Blade Set

These wooden, fully symmetrical blades are very impressive indeed. Ours were almost perfectly matched and needed little additional balancing. More than any other option, this set will help your Shuttle to perform advanced acrobatics. You hot-doggers out there will find it a useful addition to your ZX. Like the stock blades, they're weighted, covered and have the blade mounts already attached. These blades have 10 percent more chord than stock blades. When we tested them, we found we had to reduce the pitch curve. We think this may be the result of the increased area of the SE blades.

• SE Guide Pulley

Ball bearings definitely make the tail belt operate more smoothly.

• SE Tail Boom

The SE tail boom is only a cosmetic change. It's identical to your stock tail boom, but it's black anodized.

• SE Landing-Gear Assembly

This option is an alternative to the stock landing gear. You could use it when scale bodies are employed, or during cold weather, when stock nylon units might be more likely to crack. This gear is $\frac{3}{4}$ inch shorter than the stock gear.

• SE Tail-Boom Brace

Like the tail boom, this is a black-anodized version of the stock ZX part.

• SE L-Type Levers

These machined parts have bearings that support the servo's input to the swashplate. They help to tighten the roll-control push/pull system, which eliminates flexing and slop.

We found that the holes used to mount the balls to the levers are too big. If the holes were smaller, then they could be tapped to 2mm, but they're so large that even replacing the screws with longer ones and using nuts wouldn't work; the screws would eventually wobble in the holes. We created a bushing by cutting thin-walled brass tube that fit snugly around the thread of the screw (we had to substi-

tute a longer screw) and through the hole in the lever. We recommend that Hirobo includes one-piece balls with threaded posts that fit the holes properly.

• SE Tail-Pitch Lever

This all-metal part is stronger and improves performance. It has a ball bearing to reduce friction and slop in the tail-control linkage. When you install it on your stock Shuttle, you must modify or remove the pushrod guide (standoff) on the plastic tail-rotor housing. The length of the threaded coupler (included) makes this necessary. (It's soldered to the tail-control pushrod and is longer than the available space.) Install a new standoff that will allow maximum travel of the lever.

• SE Tail-Unit Case Assembly

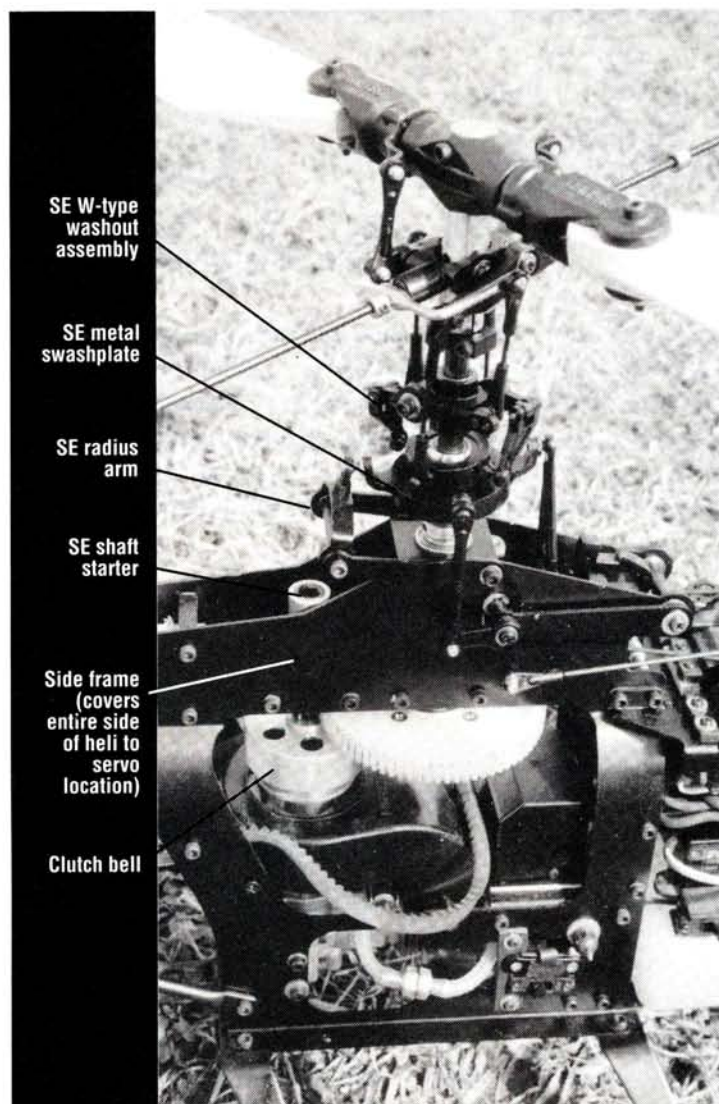
This assembly is a metal version of the tail-rotor housing. It includes the SE tail-pitch lever. Ball bearings replace all bushings, and it's rugged enough to survive even the worst abuse. This unit doesn't require the tail-pitch-lever modification previously noted.

• SE Rotor-Head Assembly

This head is the ultimate in machined-aluminum precision. Its thrust bearings can tolerate the high rpm and weighted blades that high-performance flight requires. It seems a little pricey; this unit costs as much as the basic Shuttle without an engine—discounted price, not list price, of course!



The SE's metal side frames and servo assembly are shown. You can see the machined nylon main gear and the clutch from the top. Note the metal landing gear and SE muffler.



• SE Main Gear

A "key" addition for modelers who want smooth transmissions, this beautifully machined nylon piece should eliminate wobble from the stock unit. It also sports an aluminum autorotation clutch housing.

• SE Main-Frame Assembly

• SE Servo-Mount Assembly

We've combined these upgrades because their instructions state that they must be used as a pair. If you've ever crashed your Shuttle hard enough to damage the stock, plastic side frames, you'll appreciate these metal side frames. The servo-mount assembly eliminates servo-tray flexing so that all of your servo's torque is transmitted to the flight controls.

• SE Shaft Starter with Clutch Bell

If you dislike belt-starting or have a scale fuselage on your heli, this option is for you.

• SE Muffler

This one-piece muffler had two great impacts on our Shuttle: it reduced noise by almost 3dBa, and it increased power. This required a pitch-curve change to prevent the head from overspeeding.

• SE Metal Swashplate (8mm)

This swashplate reduces slop in four places. The fit between the main mast and the center ball is improved. The fit of the ball in the upper ring of the swashplate is also excellent. There's no noticeable slop between the upper and lower halves of the swashplate. Finally, the SE unit uses high-quality individual metal balls that thread into the metal body of the swashplate (the stock unit uses plastic balls). The benefits of this modification are instantly noticeable. If you already have the optional SE radius

arm, you'll need an additional ball to tie it to this swashplate.

REMARKS

The options used to set up a Shuttle for basic AMA helicopter competition are different from those used for hot-dog flying. As much as Altech and Hirobo would like you to buy all of their option packages, you should analyze your needs carefully, and limit your purchases to the options that will benefit your style of flying.

FLIGHT PERFORMANCE OF THE GOLD SHUTTLE

The machine went through many interesting stages as it became a Gold Shuttle, and some of the combinations created unique results that are worth mentioning.

The best options are the SE radius arm, the SE W-type washout assembly and the SE metal swashplate assembly. These few modifications

(Continued on page 99)

BREAK IT DOWN

Each time we added a part to our test Shuttle, we identified and evaluated the improvement that it made to the heli. Along the way, we noticed that the options fell into the following categories. This list is organized in descending order of preference within each category to show which options, in our opinion, offer the most improved performance and value.

POWER-TRAIN EFFICIENCY ENHANCEMENTS

PART	PART NO.	PRICE
SE Clutch Bell	0402230	\$46.98
SE Main Gear	0402243	82.98
SE Guide Pulley	0402235	12.50
SE Shaft Starter with Clutch Bell	0402247	121.98

DURABILITY AND STRUCTURAL ENHANCEMENTS

PART	PART NO.	PRICE
SE Main-Frame Assembly	0402245	\$155.98
SE Servo-Mount Assembly	0402246	72.98
SE Tail-Boom Brace	0402238	12.50
SE Landing-Gear Assembly	0402237	42.98
SE Tail Boom	0402236	14.50

FLIGHT-PERFORMANCE ENHANCEMENTS

PART	PART NO.	PRICE
SE Metal Swashplate (8mm)	0402140	\$82.98
SE Radius Arm	0402232	46.98
SE W-Type Washout Assembly	0402233	82.98
SE Muffler	0402248	58.98
SE Symmetrical Blade Set	0402234	46.98
SE L-Type Pitch Levers	0402239	21.98
SE Tail-Pitch Lever	0402240	21.98
SE Tail-Unit Case Assembly	0402241	119.98
(includes SE tail-pitch lever)		
SE Autorotation Tail-Drive Assembly	0402231	14.50
SE Rotor-Head Assembly	0402242	289.98

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58 BOE FIGHT P12 \$58 60 STIN A LOW W3M \$48

59 CUR J40 JENNY \$32 120 STIN A LOW W3M \$48

60 CUR J40 JENNY \$32 561 CURTIS P56A FTR \$34

61 CUR J40 JENNY \$32 112 CURTIS P56A FTR \$56

62 CUR J40 JENNY \$32 57 DH LEOPARD-MTH \$36

63 CUR J40 JENNY \$32 57 CURTIS NC-4 \$55

64 CUR J40 JENNY \$32 62 CURTIS NC-4 \$56

65 CUR J40 JENNY \$32 94 CURTIS NC-4 \$59

66 CUR J40 JENNY \$32 51 BRUN-WINKL BIRD \$32

67 CUR J40 JENNY \$32 63 LIND LOCK SPRLS \$36

68 CUR J40 JENNY \$32 47 BAYLES GEE-BEE \$44

69 CUR J40 JENNY \$32 30 HOW RACE "PETE" \$32

70 CUR J40 JENNY \$32 47 CURT HAWK P-6 \$44

71 CUR J40 JENNY \$32 60 CURT SPARK F502 \$50

72 CUR J40 JENNY \$32 31 LOCKHEED VEGA \$46

73 CUR J40 JENNY \$32 49 DOOLIT GEE-BEE \$46

74 CUR J40 JENNY \$32 48 MONOCOQUE SPORT \$36

75 CUR J40 JENNY \$32 41 BOE FIGHT P12 \$44

76 CUR J40 JENNY \$32 47 HOW MR MULLIGAN \$32

77 CUR J40 JENNY \$32 44 SUPERM SPITFIRE \$38

78 CUR J40 JENNY \$32 30 REP T201 P-47 \$18

79 CUR J40 JENNY \$32 28 FOCKE-WULF FTR \$18

80 CUR J40 JENNY \$32 28 GRUMMAN WILDCAT \$32

81 CUR J40 JENNY \$32 56 GRUMMAN WILDCAT \$38

82 CUR J40 JENNY \$32 30 MITSUBISHI ZERO \$14

83 CUR J40 JENNY \$32 40 GRUMMAN WILDCAT \$38

84 CUR J40 JENNY \$32 49 LOCK HUSON BOM \$32

85 CUR J40 JENNY \$32 31 GRUMMAN WILDCAT \$38

86 CUR J40 JENNY \$32 31 BOE FLY FORT B17 \$40

87 CUR J40 JENNY \$32 50 N AERONAUT \$40

88 CUR J40 JENNY \$32 46 PALFZ SCOUT DII \$32

89 CUR J40 JENNY \$32 30 DOUG DC-3 TRANS \$32

90 CUR J40 JENNY \$32 47 DOUG DC-3 TRANS \$32

91 CUR J40 JENNY \$32 43 HAWKS TEXACO \$36

92 CUR J40 JENNY \$32 10 LOEN C-2 AMPHIB \$45

93 CUR J40 JENNY \$32 62 CURT AIR EXPRESS \$40

94 CUR J40 JENNY \$32 63 CURT AIR EXPRESS \$40

95 CUR J40 JENNY \$32 94 CUR SEAHAWK F7C1 \$50

96 CUR J40 JENNY \$32 48 GL GLADIATOR FTR \$32

97 CUR J40 JENNY \$32 34 LINDBERG N-3211 \$32

98 CUR J40 JENNY \$32 11 FAIRCHILD T/W \$32

99 CUR J40 JENNY \$32 49 WACO D-2 EXPORT \$34

100 CUR J40 JENNY \$32 37 WESTLIND LYSANDR \$32

101 CUR J40 JENNY \$32 51 VOUGHT VE-7 & 9 \$38

102 CUR J40 JENNY \$32 35 LOENING C-2 AMPHIB \$45

103 CUR J40 JENNY \$32 35 LOENING C-2 AMPHIB \$45

104 CUR J40 JENNY \$32 35 LOENING C-2 AMPHIB \$45

105 CUR J40 JENNY \$32 35 LOENING C-2 AMPHIB \$45

106 CUR J40 JENNY \$32 35 LOENING C-2 AMPHIB \$45

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AIRWAVES

(Continued from page 75)

small, not too warm or well-supplied cellar and enjoying every minute of it. We use to tell my Mom, "at least it keeps us home!" But seriously, any hobby makes for family involvement and togetherness. It's hard to measure this type of value. Who knows, maybe in another 20 years you'll send another photo with five generations included. Good luck! GY

(Continued on page 116)

INFINITY

(Continued from page 79)

While flying, the switch positions are very easy to get at, and the rocker-type switches are less likely than the usual toggle type to be actuated accidentally.

During flights with the Legend, I made sure that I flew from the center of the pilot area, having completely encircled myself with other pilots and their radios. On final approach, I even put several pilots between me and my sailplane. Not once did I notice a glitch or actuation of the fail-safe. The link between the Infinity transmitter and the receiver was solid at all times.

I flew the Calm 25 at Miles Square Park—the busiest power field in Southern California. My frequency position on the flight line was close to one end, making my takeoff run along the entire length of the flight line—right past everyone else's transmitter. Again, not a single glitch, and if the fail-safe ever came into play, I wasn't aware of it.

I fly with my thumb and index finger grasping the tops of the sticks. The Infinity's ergonomically shaped transmitter is better suited to fliers who grasp the radio with both hands and fly with their thumbs. I don't usually use a neck strap, but I find it easier to hold and operate the Infinity when using one.

CONCLUSION

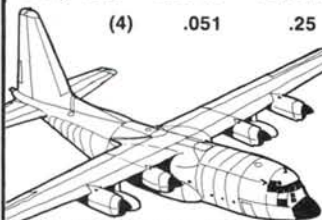
The Infinity is a great radio for pilots who fly a

(Continued on page 99)

C-130 "HERKY-BIRD"

1:30 1:18

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transportable

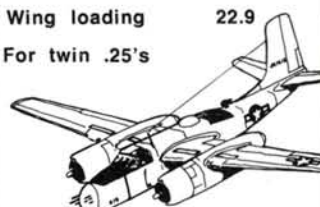
THE RIGHT SIZE

economical components

A-26B "INVADER"

Scale 1:12

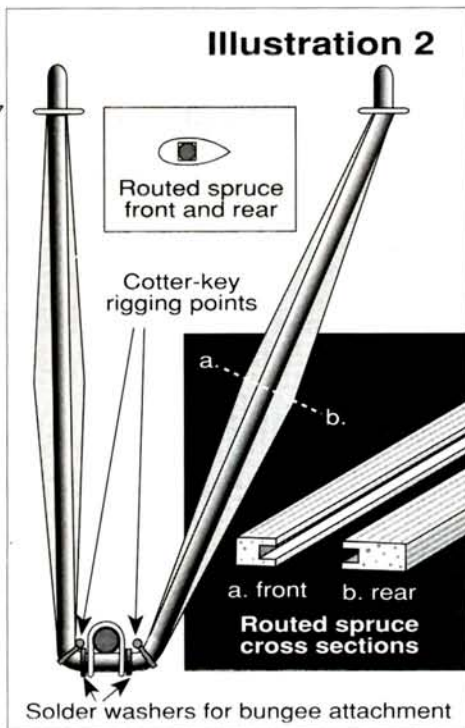
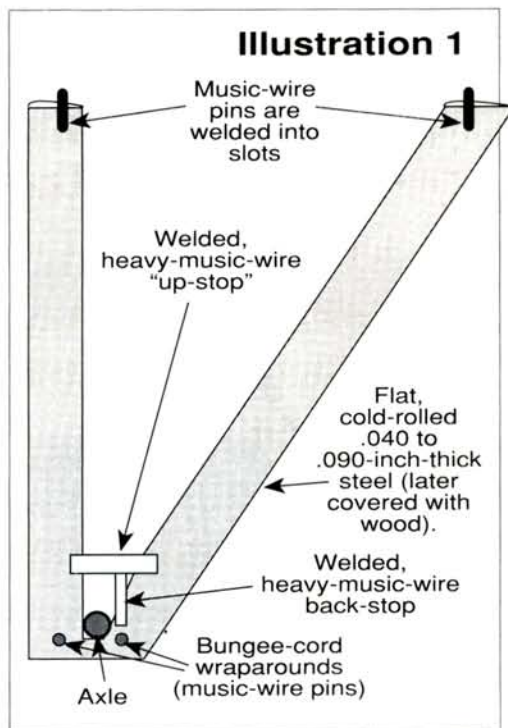
Wingspan 70."
 Wing area 540.5 sq."
 Wing loading 22.9
 For twin .25's



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HOW TO

Make WW I Scale Landing Gear



by CLARKE SMILEY

MODEL AIRPLANE landing gear might be nothing more than balsa sticks, or they might be as complicated as the systems found on full-scale aircraft. When you're out of the featherweight class, landing gear must fulfill two functions:

- They must let the craft move along the ground under control.
- They must be able to absorb and

dissipate the energy generated as the airplane touches down (the gear flexing that you've seen on the student pilot's trainer is the most obvious example). If the gear can't handle the loads generated on landing, the gear and, quite possibly, the plane will break!

When making WW I landing gear, there's one main problem: how do you engineer gear that will dissipate the energy of landing, yet retain a scale landing-gear appearance?

In Sketch 1, I show the Sopwith-type landing gear, which works well if you want super strength and good shock absorption. The gear "V" is made out of flat, cold-rolled steel. The pins in the top fit

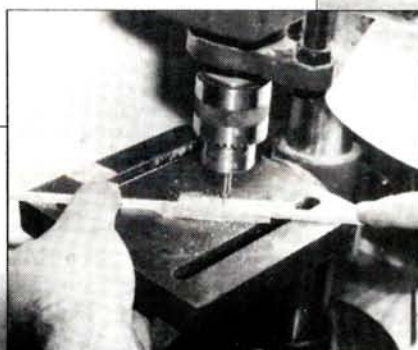
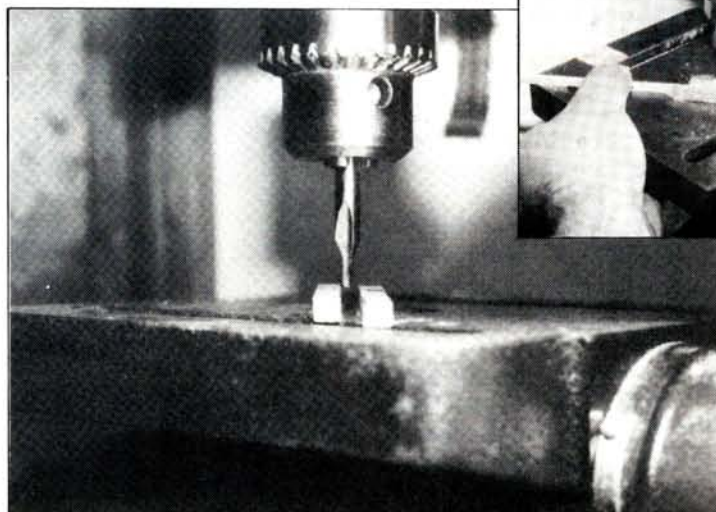
into holes in the bottom of the airplane. These pins should protrude from the top of the gear legs about 1/4 inch—no more than that. They're welded into slots that have been cut in the legs.

No adhesive is used to hold the pins in their mounts in the fuselage. I believe in letting the rigging hold the gear tightly to the plane. (I use 15-pound test, stainless-steel, nylon-coated fishing leader.) This way, the whole gear will come off in a hard landing, and I only have to replace some rigging points. The back-stops and the up-stops are made of heavy music wire and are welded into slots cut in the rolled steel.

Almost any sheet-metal shop will shear

some stock for you, and if you make the notches for all the pins, they'll "weld up" your gear. I've used this type many times and have found that .040- to .060-inch-thick steel works well. After this has been assembled, it can be covered with balsa or hard wood and sanded to an airfoil shape. On

Achieve strength and scale looks



▲ 3. These washers limit how far the gear legs can go into the fuselage. The top ends will be trimmed to 1/4 inch. The lower washers center the axle and hold the "bungee" cords.

▲ 2. The drill press should be set at its top speed. The wood is passed slowly through the guide, leaving a channel for the music wire.

▲ 1. A close-up of the router system I use for cutting slots in hardwood. The two pieces of spruce are glued to the drill-press table to act as a guide. A router bit is used.

PHOTOS BY CLARKE SMILEY

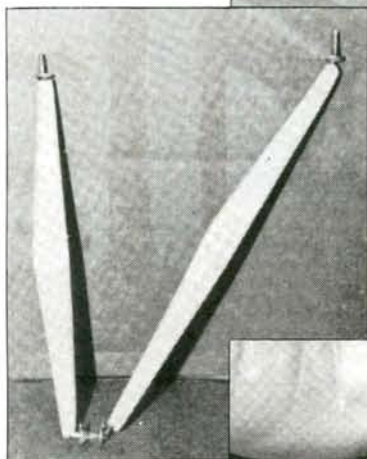
WW I Scale Landing Gear

larger aircraft, .090-inch-thick steel wouldn't be considered overkill.

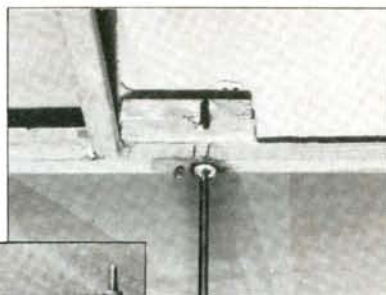
Sketch 2 shows my favorite gear design for .20- to .40-size vintage planes. I use the heaviest music wire and enclose it in routed spruce. Photos 1 and 2 show a routing jig that you can make using a drill press. You can make your own bit by sharpening a piece of music wire of the same size that you use for your gear. I bought a Sears $\frac{5}{32}$ -inch pin router and have had good luck using it with a guide that's glued with CA to my drill-press table. This way, I can make my own stock for struts and the like.

Photo 3 shows the start of a gear "V." I've soldered small washers to the top of the gear legs as stops for my gear anchor "pins." At the bottom of the "V," I've soldered two more washers that center the axle. In Photo 4, I've covered the wire with routed spruce, which I've sanded to shape.

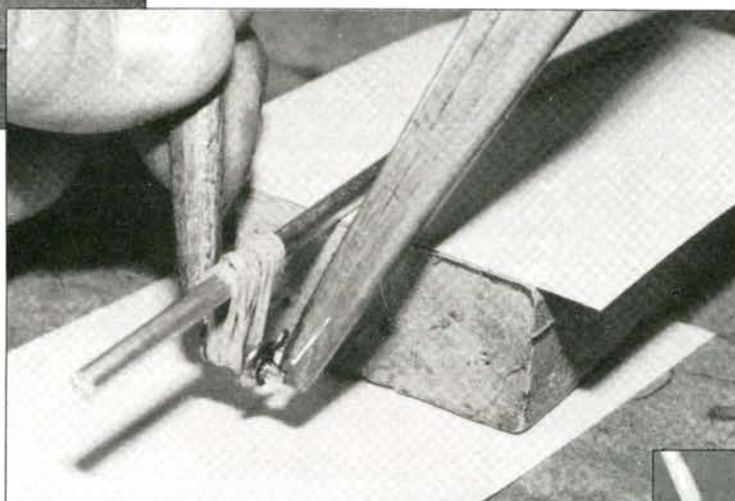
Photo 5 shows the bottom longeron to which I've added extra blocking against which the gear can rest. If you look closely, you'll see a rigging point just to the left of the wire leg. I use the eyelet ends of cut-off fish hooks for this. They're made of a very hard steel and, when glued into place, they



4. Here, I've covered the wire legs with routed spruce and sanded them to shape.



5. Looking up into the bottom of the fuselage, you can see how the washer acts as a gear stop. The extra blocking is spruce. A fishhook rigging point can be seen just to the left of the landing-gear leg.



6. & 7. These pictures show the extended axle at rest. The amount of "give" is determined by the number of "wraps" of rubber. This type of suspension allows the rubber to center the axle. In Photo 6, just behind the forward strut, you can see the loop of a rigging point. (They're soldered at the same time as the lower washers.)

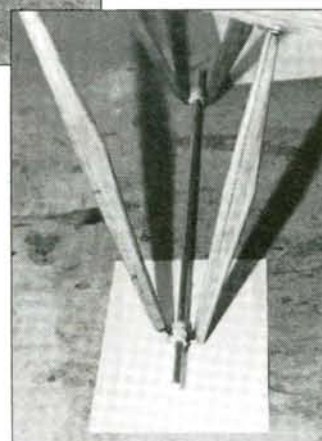
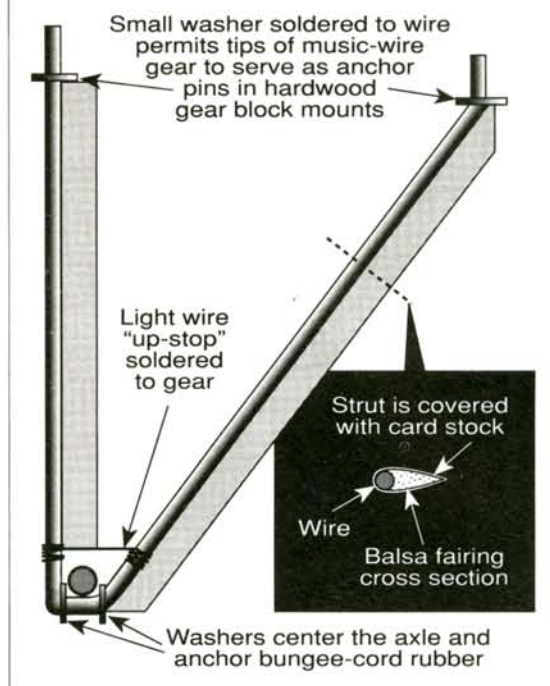
provide strong attachment points for rigging wire. During a hard landing, they'll pull out without causing any significant damage, and they can be quickly glued back into place. It's best to drill the holes for the rigging points slightly oversize and use gap-filling CA in them.

Photo 6 shows the amount of "give" in the rubber that anchors the axle to the wire-covered gear. You can adjust this by varying the number of "wraps" of rubber. The

rubber should be wrapped inside the washers so that they'll be centered; the rubber also provides further shock absorption.

Sketch 3 shows a different way to produce a streamlined strut. Balsa is used to make an airfoil shape, then it's covered with card stock. I've also tried using aluminum tube for landing gear, but I've had only limited success. The tube doesn't withstand compression unless it's supported by a dowel or a hardwood insert.

Illustration 3



I hope that I've given you some ideas on making scale landing gears for WW I aircraft. If I can be of further help, feel free to contact me: Clarke Smiley, 23 Riverbend, Newmarket, NH 03857.

INFINITY

(Continued from page 86)

wide variety of models. Its programming and mixing capabilities may be better for power flying, but glider guiders will find that it meets most of their needs—and at a substantially lower price than the more complex glider radios.

The feature that really makes the Infinity stand out is that the switch positions are "user assignable." With this, you can tailor the feel of the radio to your liking and the type of model you fly. That you can double up the switch positions to engage more than one dual rate at a time, or multiple mixers, or even dual rates and mixers at the same time, opens up quite a few new possibilities.

Initially, I wasn't overly impressed with the Infinity's feel and mixing capabilities, but as I spend more time working with it, I become more impressed with its versatility. When flying it in the Legend, I don't really miss having the more complicated features of a "glider-dedicated" radio. And I actually concentrate more on my flying and less on what radio feature I need to turn on or off, just to keep airborne. Plus, I can now use just one radio to fly my sailplanes, power models, or electrics. What more could you ask for?

*Here's the address of the company featured in this article:
Airtronics Inc., 11 Autry, Irvine, CA 92718.

UPGRADE PARTS

(Continued from page 85)

had a spectacular effect on flight performance. Hover performance (the reason why the Shuttle has always been a good trainer) became so tight, crisp and precise that the machine could hover through all of the AMA's competition events with an accuracy that's usually only achieved by .60-size competition helicopters. Extended periods of "hands-off" flight and pinpoint-accurate landings became commonplace. In fast, forward flight, the Shuttle was more manageable and didn't "balloon" as it climbed out of high-speed passes.

The next improvement came when we installed the SE muffler. This unit is matched to the Enya SS35 heli engine, and we had to make changes in the pitch curve to compensate for the power increase. We really appreciated the power increase later when we added the weight of the metal side frames, the servo-tray assembly and the metal landing gear.

The addition of the SE symmetrical blades (to all of the previous mods) really made this machine a hot-dogger's dream. It possessed a power-to-weight ratio that allowed the Shuttle to climb aggressively and fly smoothly through the bottoms of high-G maneuvers that would cause other helicopters in its class to sag in both power and rotor speed. It withstood constant,

(Continued on page 114)

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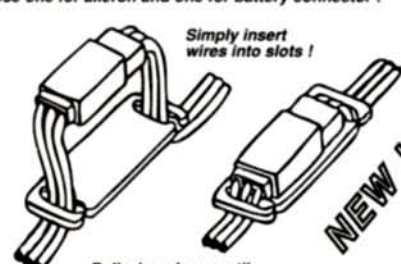
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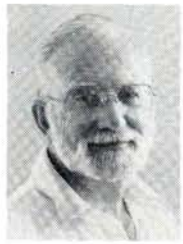
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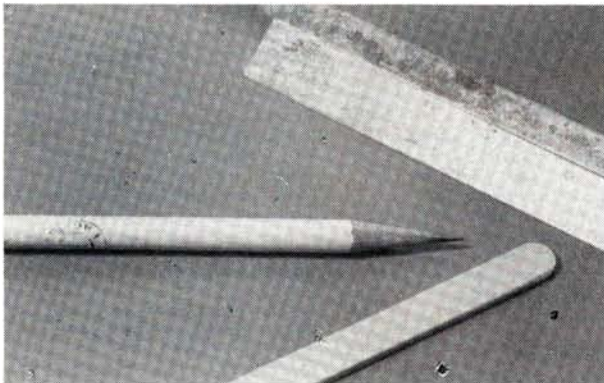
How To:



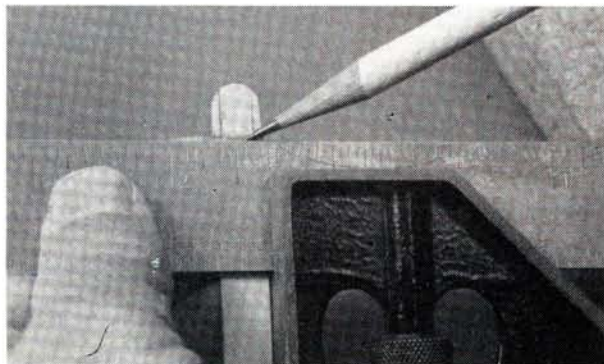
R A N D Y R A N D O L P H

MAKE A CLEVIS TOOL

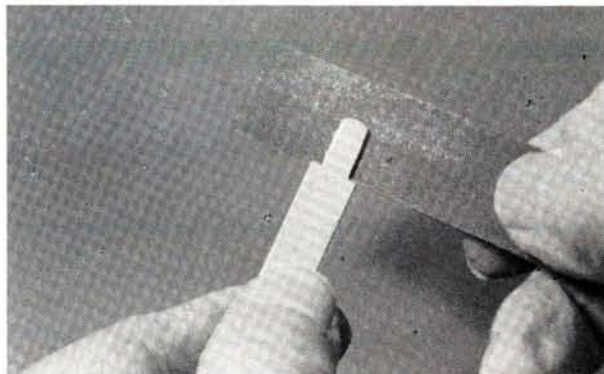
WHEN YOU WANT to remove a control horn to adjust the length of the pushrod, you can split the clevis with your fingernails, a screwdriver, or a pair of long-nose pliers. All have disadvantages, though. To deal with clevises of standard size, keep this simple tool in your flight box, and you'll save time—and temper!



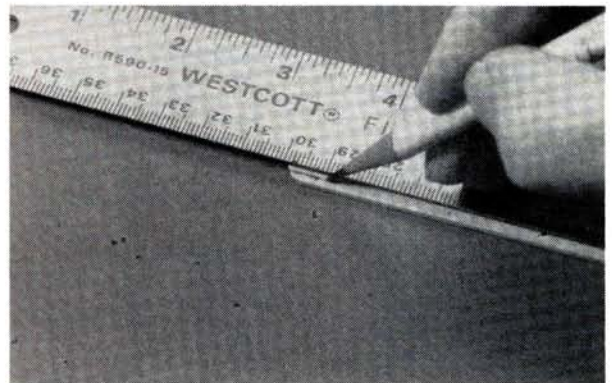
1. You'll need a popsicle stick or half a tongue depressor, a ruler, a pencil and a razor saw.



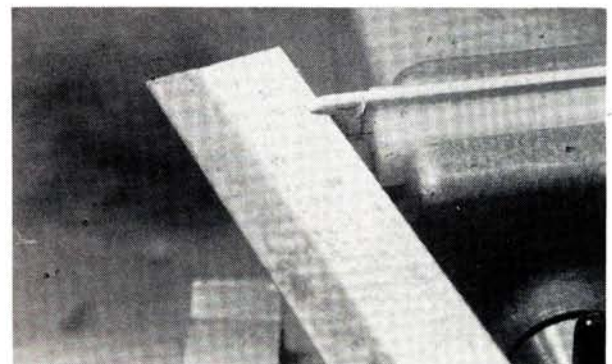
3. Measure $\frac{1}{4}$ inch from the same end of the stick, and draw a line across it at that point. (It should be at 90 degrees to the parallel lines.) You'll cut along each side of this line to make the shoulder that will limit how far the tool goes into the clevis.



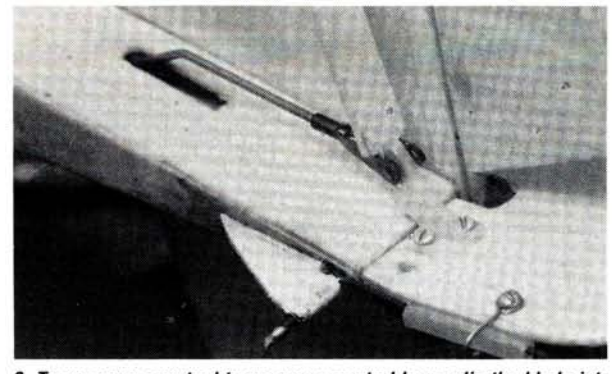
5. Use a sanding block to round the blade slightly. If you want to, you can round the shoulders, too. That's all there is to it.



2. At one end, draw two lines $\frac{3}{16}$ inch apart and parallel to the stick sides.



4. To make the tool's blade, carefully make shallow saw cuts at the shoulder marks, then saw along the parallel lines to the end of the stick. Try to keep the parallel cuts truly parallel. (A small vise will be helpful.)



6. To use your new tool to remove a control horn, slip the blade into the clevis and twist it. Having made the necessary adjustments, re-connect the horn by opening the clevis in the same way.

One step closer
to F3E



GRAUPNER

Cherry

II

by CLYDE GEIST



JUDGING BY the imported electric sailplanes I've seen, Europeans seem to be producing equipment for a variety of pilot skill levels. Graupner's T-tail Cherry II SE is recommended for those who are proficient at flying high-performance sailplanes, such as the UHU or the Chip. I assume "SE" stands for sport electric.

In theory, the Cherry II breaks all the "good glider" rules. It's heavy, its airfoil is thin, and it doesn't use a gear-drive system, but the fact is, this airfoil uses the powerful lift available at higher air speeds to produce

a surprisingly flat glide. These flying qualities are required for today's high-speed competition. The Cherry II, therefore, seems to be a small step toward F3E competition design. I've had flights of over 30 minutes during our northern midwinter, but every advantage has its price. The Cherry's capable performance is possible only when it has been properly balanced and carefully trimmed. Turbulence challenges control, but experienced fliers delight in it because turbulence signals an alert R/C pilot to thermal activity.

S P E C I F I C A T I O N S

Manufacturer: Graupner
Type: Precision electric sailplane
Price: \$324.95
Wingspan: 87 inches
Wing area: 550 square inches
Wing loading: 17 ounces per square foot, 15.2 ounces as flown
Weight: 64 ounces specified (with Speed 700)
Length: 40 inches
No. of channels req'd: 4 (two ailerons, elevator and throttle)

Radios used: Futaba Attack S (used with Ace Christy mixer), Futaba Super 7 PCM
Motor used: Graupner's standard Speed 700, turbo ball-bearing 700 9.6V and Ultra 900 cobalt 9.6 version

Prop used: Graupner's folding 10x6 and 9x5

Airfoil: Eppler 211 modified

Wing construction: sheeted foam.

Features: this complete ARF kit includes a plastic fuselage, rolled plans and pre-covered, sheeted-foam wings. Tail surfaces are assembled and covered. All required hardware is included.

Hits

- The Cherry II is capable of sport aerobatic stunts, thermal gliding and precision maneuvers.
- The strong airframe instills confidence during high-G maneuvers.
- Graupner parts and support systems are readily available.
- The removable tail plane can be stored flat.

Misses

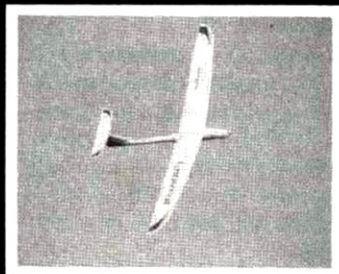
- The pre-covered, blue wing bottom disappears in clear skies.

FLIGHT PERFORMANCE

The plane was tested in zero wind conditions.

• Takeoff and landing

Hand-launching this high-speed model requires a firm, level toss. With 10-cell power, it's out of sight in 30 seconds. When it's time to land, the glide remains flat, and landings are gentle. Early flights without spoilers (i.e., "spoilerons" where the ailerons turn up) simply required more landing area, but spot landings (point landings) proved challenging without them.



• High-speed performance

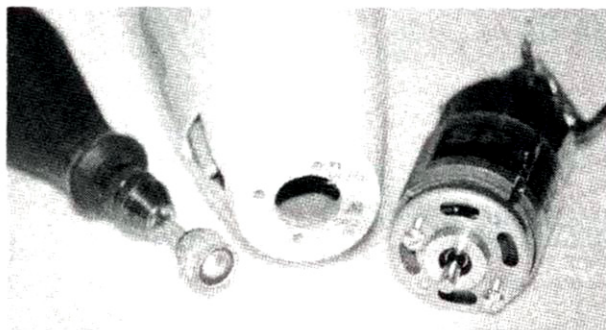
The plane was designed to climb briskly and glide fairly fast; it accomplishes both in style. The Cherry II glider uses power merely to climb. In normal glide, it's faster than some electrics under power. The recommended differential control throws allow sharp thermal turns without stalls. The appropriate fast glide trim is best for all conditions. If you put the nose down slightly, it increases glide speed dramatically.

• Low-speed performance

The high-performance glider is slow to respond and prone to stalling in turns at just half the normal glide speed. I avoid it! When a stall does occur, the nose and, often, one wing drops. Leveling the wings while cautiously applying up-elevator gets it out with about a 30-foot loss in altitude.

• Aerobatics

While in a glide, rolls, loops, split-S's, Immelmans and related aerobatics are possible as long as a reasonable loss of altitude is tolerated. With power on, it can accomplish additional maneuvers, such as outside loops, large inside loops and others. Upside-down flight requires just a little elevator. The fact is, under Ultra 900/10-cell power, it climbs at more than 45 degrees upside-down. Vent holes around the motor allow it to run cool; battery cooling vents aren't provided.



The nose has been modified with a Dremel drum sander to accept the Speed 700 motor—the ball-bearing version.

KIT CONTENTS

The rolled plans (apparently computer-generated) are well-done. The major components—the two wings, the fuselage and the elevator—complete the airframe. High-quality hardware parts are sorted, bagged and riveted to the box sides. Bubble wrap and tissue protect the works.

**"Graupner's* T-tail
Cherry II SE is
recommended for
those who are
proficient at flying
high-performance
sailplanes..."**

CONSTRUCTION

The instructions begin by describing the radio and motors required. Power options include the standard Speed 700 version, a sport version utilizing the Speed 700 Turbo ball-bearing motor, or the Ultra 900, which will make it a competition ship. Initially, I chose the standard version exactly as shown on the plan. The power is switched on and off with the recommended Graupner miniswitch 40, and eight Sanyo* 1400 SCR cells are used for power. The tough ABS plastic fuselage requires a compatible adhesive. My experiments with adhesives proved that the recommended Stabilit Express* is best. Pacer's* Zap-a-Dap-a-Goo also works, and thick CA works in a pinch.

The Cherry II is pure ARF; it goes together quickly. My efforts to understand the literal English translation of the German instructions, however, sometimes resulted in frustration.

FUSELAGE

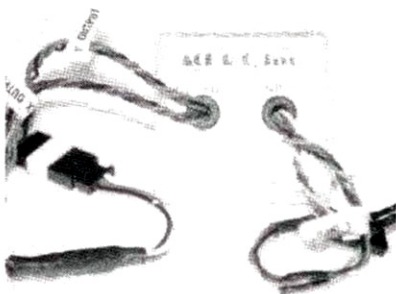
The tough, one-piece ABS plastic shell comes ready for equipment installation. I began by making openings for the motor linkage, the wing-mounting devices, etc. The

CHERRY II

elevator control cable begins at the upper fin, runs forward through the bulkhead and on to the servo area. The servo tray (provided) fits an S-133 Futaba* servo perfectly. (Kyosho KS-31 or Airtronics micro servos won't fit.) The servo assembly is secured with a liberal dose of adhesive. A double-sided adhesive

gasket attaches the power switch and receiver to the fuselage bottom, and a 250mAh receiver pack is mounted above the elevator servo. I used a large receiver, which barely allows a sub-C motor battery pack to fit in its compartment, so a compact receiver is a better choice.

Following the plans, I drilled motor-mounting holes through the plywood-supported nose. The instructions tell you to glue the plywood cabin former into place, but the plans show it screwed on, so I did both. Before installing the completed floor plate, I finished all the inside electrical work. The hatch is secured with



An Ace Christy mixer can save big bucks.

a 5mm steel pin up front and a slide lock that's glued into the fuselage. Next, I glued in two brass tubes for the wing rod and the alignment pins.

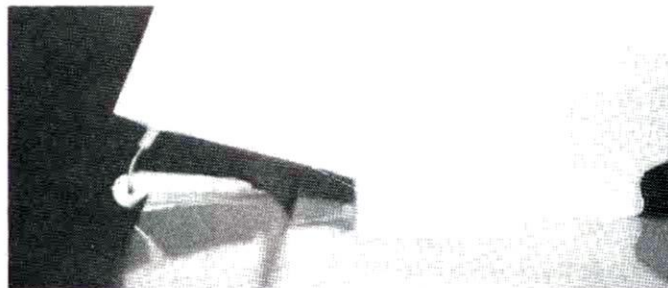
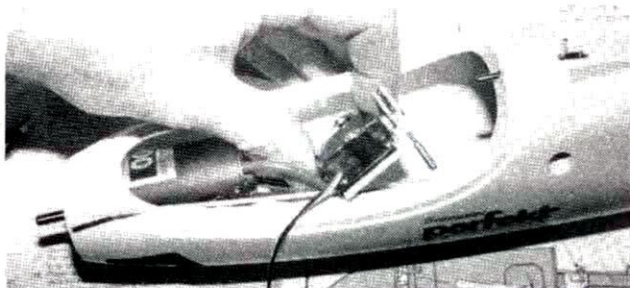
ELEVATOR

The tail plane is secured with a 4x15mm nylon screw and a threaded steel insert that's glued inside the fin. The control rod is attached to the control horn with a Z-bend. The horn is glued to the elevator.

WING

Graupner recommends that you trial-fit the wings to the fuselage and check for warping wings by measuring along the wing bottom to a flat surface. The wings

CHERRY II



■ Left: The servo in its mounts is attached to the forward fuselage. Note how clear the drawing is. ■ Right: The unique elevator linkage is simple in design.

ULTRA PERFORMANCE "HOP-UP"



After comparing the Speed 700 Turbo 9.6V motor in its standard bushing version with its ball-bearing counterpart, I've come to respect the brute power this motor delivers. But sometimes, merely respectable performance isn't enough. To be competitive in today's limited motor-run competitions, you need im-

proved performance, no matter what! Graupner produces the high-performance alternative, a line of all-out motors called "Ultra."

The Ultra 900 is recommended as the hop-up motor for the Cherry II. The Ultra 900 features samarium-cobalt magnets, ball bearings, replaceable brush assemblies with heavy copper braid hookups and more. I counted seven armature slots (not the usual three), which allow for more efficient use of available current. This is especially desirable for direct-drive applications, such as the Cherry. The Ultra 900 weighs 3 ounces less than the less powerful Speed 700 motor. Just look at the numbers in the performance chart. In order to really appreciate "Ultra" performance, however, you've got to fly it for yourself.

Speed 700 Turbo Ball Bearing

7-CELL				8-CELL			
prop	rpm	amp	thrust (oz.)	rpm	amp	thrust (oz.)	
9x5	8,100	16.7	22	8,900	19.6	26	
9x7	7,200	19.5	28	8,100	24.2	32	
10x6				7,500	28.5	30	
11x7	5,700	27.2	27	6,050	31.0	29	
10-CELL				12-CELL			
prop	rpm	amp	thrust (oz.)	rpm	amp	thrust (oz.)	
9x5	9,800	22.3	30	11,100	30.1	36	
9x7	8,900	28.7	33	9,400	33.2	43	
10x6	8,100	34.0	33	8,300	36.0	36	
11x7	6,100	36.0	31	*	*	*	

(The standard Speed 700 motor produced equivalent results.)

Ultra 900

7-CELL				8-CELL			
prop	rpm	amp	thrust (oz.)	rpm	amp	thrust (oz.)	
9x5	9,900	25.5	25	10,300	31.0	31	
9x7	8,000	27.5	31	8,500	33.0	40	
10x6				8,600	36.0	39	
11x7	6,000	35.0	30	6,100	37.0	31	
10-CELL				12-CELL			
prop	rpm	amp	thrust (oz.)	rpm	amp	thrust (oz.)	
9x5	10,900	33.3	34	11,200	36.0	36	
9x7	9,500	39.3	44	10,100	43.0	53	
10x6	9,400	41.0	48	*	*	*	
11x7				*	*	*	

*Not recommended, owing to excessive current draw.

Thrust figures are averaged. The rpm is the average of the first 5 seconds of run time (after 30 seconds, rpm fell about 10 percent). Graupner folding props were used throughout, and the battery packs consisted of Sanyo 900mAh SCR cells and were peak-charged at a 4.5A rate. Motors were broken in for 5 hours at 4.5V and with no load. The manufacturer doesn't recommend running these motors on 7 cells; a comparison was made because of the popularity of 7-cell competition events.

are supported with an 8mm-diameter steel rod and secured with a nylon fork and a wedge. Two servos, one in each wing, provide aileron control. The drawing shows where you should cut a rectangular hole in each wing. I mounted the aileron servos directly on the upper sheeting with double-sided tape, instead of with the optional Graupner mount. Offsetting the servo arm forward provides aileron differential. A factory-installed tube guides the servo wire to the fuselage.

FINAL ASSEMBLY

From the start, I planned to try different battery and motor combinations. Proper balance is maintained by using Styrofoam spacer blocks to hold each battery in place. Applying the kit's decals completed the model.

RADIO INSTALLATION

With the construction completed, I proceeded to set up control throws. That's when I noticed the plans show spoiler control. I had installed a non-mixing radio and connected both aileron servos to the receiver with a Y-connector. After some thought, I resolved to "mix in" spoilers later. After a dozen flights, I discovered an inexpensive solution.

The Ace* Christy mixer can use the rudder channel on any non-PCM radio to control the spoilers. Editor Tom Atwood suggested that I hold the rudder stick to the left side with a rubber band to use full stick travel and, hence, full servo travel. This setup was necessary because the Christy mixer reduces servo travel by 50 percent.

The Christy mixer worked well, but it didn't permit the recommended differential, i.e., down throw of 50 percent. The need for mixing capabilities prompted my purchase of a Futaba 1024 Super 7 radio system. Now I have spoilers, and I can program servo differential to match Graupner's specifications precisely, (this is almost impossible to do mechanically). Simple 4-channel control makes the Cherry II a great plane with which to learn radio programming.

(Continued on page 114)

JET BLAST

G E O R G E L E U



T-38 FINISHING TIPS

ONE OF THE most popular aviation book series currently in circulation is the "In Action" series from Squadron/Signal Publications. Each of these soft-bound books features approximately 50 pages of photos, drawings, full-color, airbrushed artwork and text. New books are published about every month, and they feature obscure as well as famous aircraft.

I find these books well-done and interesting. Before I buy a particular scale aircraft design, I use this series to determine how many modifications I'll need to make the design more scale-like. Since the books aren't expensive, I can cut out photos and drawings for my scale documentation and merely buy a new book for my collection.

I've collected more than 75 of these books. Some of the early ones are out of print and have become collectors' items, while others have been released in an updated format. They're a valuable addition to any modeling library.

CUSTOM R/C AIRCRAFT AND A WHOLE LOT MORE

For the past two years, I've witnessed George Miller and Bob Thacker fly Custom R/C Aircraft's* T-38 at the Southwest Fan Fly. I've also watched Lou Lugero from Lou's Jet Age Hobbies fly one at the fan fly in Rome, NY. The T-38 exhibited good ground handling and excellent flying characteristics.

Rolls were fast, as were many other maneuvers. The T-38s flew with authority and exhibited the correct flight attitude. Landing pattern and set-up were performed with about one-third throttle setting, which made the approach predictable and safe. The design could be slowed to a comfortable touchdown speed. The T-38 is 80 inches long and has a 48-inch wingspan,

and the wings are permanently affixed to the fuselage. Needless to say, I had to have one.

My Custom R/C Aircraft kit arrived in a large box, which included a polyester-resin fuselage, foam wings, all-balsa sheeting for the wings, plywood bulkheads, pre-cut wood for the stubs and fin, elevator linkages and other hardware. The kit was complete, and the full-size plans and the manual made construction simple. My only design modification was to stiffen the fin by adding a lite-ply bulkhead to the tail area. I felt the

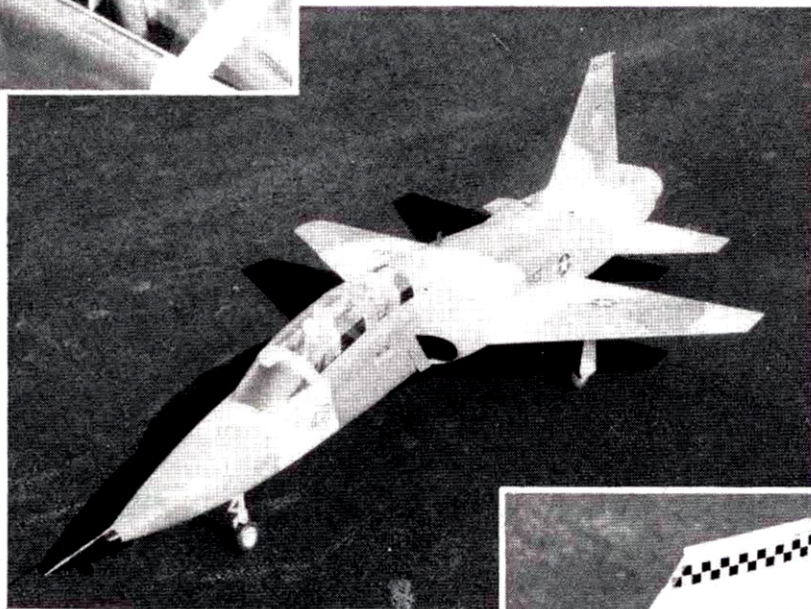
stock arrangement had too much side-to-side movement.

The instructions included information on control-surface

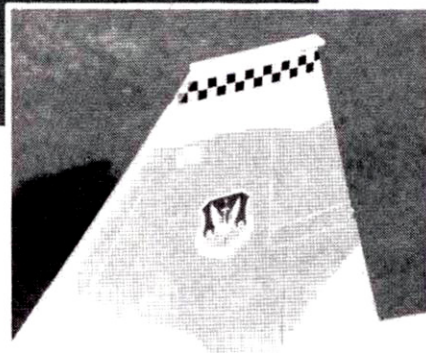
deflection and flying. The all-up weight of my plane was 13 pounds. Had I used MonoKote on the flying surfaces and made the detail less elaborate, I believe the weight would have been closer to the recommended 11½ pounds. I might add that my plane balanced perfectly at the CG without my having to add lead to the nose. That alone made me a believer in the excellence of this design.

I used Perfect Paints* (mixed to match particular Federal Standard colors) and created a four-tone gray Aggressor paint scheme. I've always had good results with this line of paints because they're fuel-resistant, and they have excellent adhesive properties. Also, the paint dries from the outside in, i.e., a "skin" quickly forms on the surface so that dust has little time to adhere to it.

(Continued on page 112)



■ Above: Custom R/C Aircraft's T-38 uses an O.S.* 77-powered Byrojet*, a JR radio and Spring Air* retract. The 13-pound model is finished with Perfect Paints. ■ Top left: the MGA pilot adds a realistic touch. ■ Right: Bob Violett's decals are just the thing for scale detailing.



For the panel lines, I sprayed paint over .030x¹/₆₄-inch chart tape and removed the tape after the paint had dried. Hatch detail was made out of pieces of MonoKote stuck to the fuselage prior to painting. (Perfect Paint adheres well to MonoKote.) I used glue drops from a hypodermic syringe to make flush rivets.

Bob Violett Models* decal sheets provided the authentic markings for the T-38. They're water-transfer types, and they adhere well. They take the shape of what is underneath them; i.e. panel lines, rivet detail and MonoKote panels. Bob Violett Models offers four decal sheets for ¹/₈-scale aircraft.

MGA Enterprises** jet pilots add the perfect finishing touch to my plane. The detailing of these ¹/₈-scale, hand-painted busts is exceptional. The heads even swivel, and I swear one of them winked at me after he had been installed in my T-38.

I used Pacer's* new Zap-a-Dap-a-Goo throughout the fuselage to glue the plywood bulkheads and servo mounts to the fiberglass. It does an excellent job of sticking wood to non-porous surfaces, such as glass, metal and ceramics. It reminds me of a cross between Duco and Ambroid cement; it's very strong, and it's easy to clean up after use.

I'll try to have a flying report and in-flight pictures of the T-38 soon. My compliments to George Miller and Custom R/C Aircraft for an excellent T-38 ducted-fan design.

COMPOSITE STRUCTURES TECHNOLOGY

I recently received a nice letter from Gail Gewain of Composite Structures Technology* (CST) that introduced me to the company and some of the products. CST specializes in vacu-bagged composite wing skins and general composite applications. The company's informative and interesting newsletter, "Tech Notes," provides tips and techniques for using composite materials.

Thanks to Gail, I recently obtained a sample of CST's Graphite Filler, which, when mixed with epoxy, reinforces any joint. It makes an excellent fillet joint around a bulkhead or a firewall. I'm quite eager to try some of their other products on my aircraft designs.

SHARPENING THE EDGE

I'm often asked how I make such sharp, straight trailing edges on my aircraft. The method I use was taught to me by Larry



Squadron Signal's "In Action" books are interesting to read and useful for scale documentation.

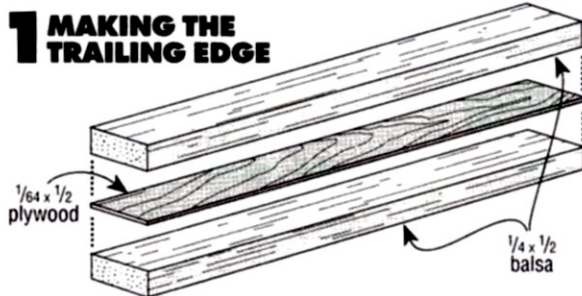
Wolfe of Jet Hangar Hobbies, and I'll pass it on to you.

Make a trailing edge by laminating a piece of ¹/₆₄x¹/₂-inch plywood between two pieces of ¹/₄x¹/₂-inch soft balsa wood. These pieces should be about 1 inch longer than the trailing edge of the flying surface you're working on.

The next step is to trim ¹/₂ inch off the rear of the wing surface and add the new laminated trailing edge. (I prefer to use a 5-minute epoxy for this.) While the glue is curing, look down the trailing edge, and adjust it until it's straight.

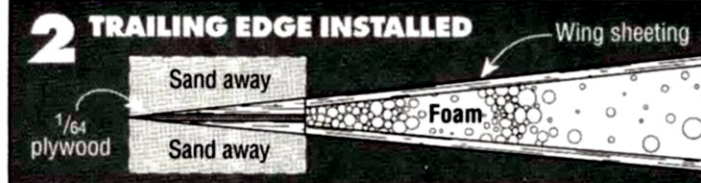
When the glue is dry, sand the laminated piece to the trailing edge of the ¹/₆₄-inch plywood. The ¹/₆₄-inch plywood, which is much harder than the balsa wood that it's sandwiched between, will become the remaining sharp edge after the balsa has been sanded away. The diagrams help to explain the procedure.

1 MAKING THE TRAILING EDGE



The balsa/plywood trailing-edge construction is durable, and it looks clean.

2 TRAILING EDGE INSTALLED



*Here are the addresses of the companies mentioned in this article:

Custom R/C Aircraft, 1140 Civic Center Dr., Rohmert Park, CA 94928.

Perfect Paint; distributed by Chevron Hobby Products, P.O. Box 2480, Sandusky, OH 44870.

MonoKote; distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.

Bob Violett Models, 1373 Citrus Rd., Winter Springs, FL 32708.

MGA Enterprises, P.O. Box 5631, Fresno, CA 93755.

Pacer Technology and Research, 9420 Santa Anita Ave., Rancho Cucamonga, CA 91730.

Composite Structures Technology, Dept. CC91-5, P.O. Box 4615, Lancaster, CA 93539.

O.S./Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.

Byrojet; distributed by Byron Originals, P.O. Box 279, Ida Grove, IA 51445.

JR Propo; distributed by Hobby Dynamics Distributors, P.O. Box 3726, Champaign, IL 61826.

Spring Air, 82 Parkhill Blvd., W. Melbourne, FL 32901.

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UPGRADE PARTS

(Continued from page 99)

hard maneuvering very well, and there was no free play or sloppiness in the control system as we logged weeks of flights on our test machine.

We have a few comments on the performance of the Enya SS35 that came installed in our ZX review Shuttle. This engine is the coolest-running heli engine in its class. It impressed us the most when we installed *every option* on the helicopter *at once*, and it *still* showed no signs of fatigue or excessive heat. This engine would really prove itself in one of the scale fuselages available for the Shuttle. We ran several gallons of fuel through it during our tests, and the engine's only negative point is that the idle-mixture adjustment required constant attention. It didn't want to maintain a setting until the engine was well broken-in.

The SE-equipped Shuttle is a superb design that has evolved over almost a decade. It takes a lot of work and attention to detail to keep pace with modelers' trends and the growth of new technology. Hirobo deserves a lot of credit for keeping the Shuttle a state-of-the-art machine.

**Here is the address of the company that's featured in this article:*

Hirobo; distributed by Altech Marketing, P.O. Box 391, Edison, NJ 08818.

CHERRY

(Continued from page 108)

The Cherry has encouraged me to experiment. I used four adhesives, three motors, two radios, two motor controls, 8-, 10- and 12-cell batteries and three propellers. Graupner's Ultra motor and Futaba's computer radio are expensive, but when I'm involved in some friendly competition, Graupner backs me with combinations of "the right stuff." This is a jib-built ARF with advanced aerodynamic design, and few builders would be able to duplicate one from scratch.

Sport flying the Cherry II taught me some competitive sailplaning and exposed me to the

(Continued on page 116)

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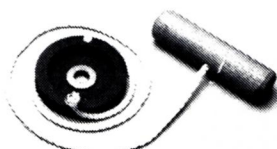


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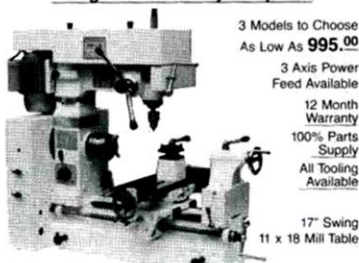


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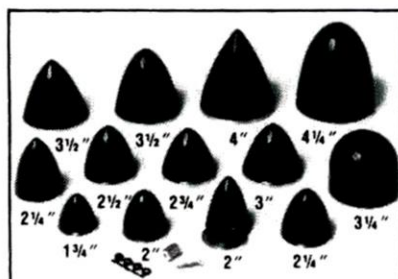
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CHERRY

(Continued from page 114)

equipment it requires. But after all, that's why Graupner produced it in the first place.

*Here are the addresses of the companies mentioned in this article:

Graupner; distributed by Hobby Lobby International, 5614 Franklin Pike Cir., Brentwood, TN 37027.

Sanyo Electric, Battery Division, 200 Riser Rd., Little Ferry, NJ 07643.

Stabilit Express; distributed by Hobby Lobby International.

Pacer; distributed by Frank Tiano Enterprises, 15300 Estancia Ln., West Palm Beach, FL 33414.

Futaba Corp. of America, P.O. Box 19767, Irvine, CA 92718.

Ace R/C Inc., P.O. Box 511, Higginsville, MO 64037.

AIRWAVES

(Continued from page 86)

KLING-FOGLEMAN AIRFOIL?

I'm building an un-powered, ultralight flying wing, and I'm considering incorporating a Kling-Fogleman step in the underside of the airfoil, which will also have Kasper tips. I'd be grateful if you could provide any information on airfoils that use this device, and can you help me locate an aeromodeler in the Los Angeles area who may wish to assist me in this project? I need to build and fly a 1/4-scale version of this wing for R&D purposes.

LARRY WITHERSPOON

4260 W. 182 St., Torrance, CA 90505

(310) 370-9793

Larry, although Dan Santich, a former editor of Model Airplane News, did build some models using the Kling-Fogleman stepped airfoil design, we aren't aware of any further developments with stepped airfoils since this novel design was publicized in the mid-'80s. Did this airfoil pan out? Readers with information on the performance of this type of airfoil may wish to get in touch with Larry. (We're also curious!)

Larry, you should team up with an able modeler and with an aerodynamic engineer who can ensure that your scale model reflects the performance of the full-scale ship. To accomplish this, the design must be slightly modified from a true scale representation to compensate for scale effects. Please keep us posted on your progress.

TA

MORE ON THE MAC

Whoa, Bubba! In the March "Airwaves" you had a discussion of mean aerodynamic chord that could lead to some shredded balsa if the CG of a model were placed as you described it. I won't go into the detailed discussion of the exact definition of MAC as it's covered in many aerodynamic texts, e.g., "Airplane Aerodynamics" by Dommasch et al, page 166, but it isn't the chord at the span location where there's equal area on either side. The MAC, as commonly used, is the chord at the location where there are equal geometric

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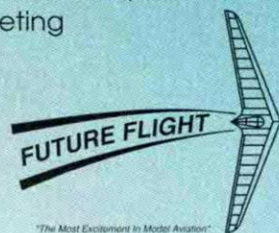
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AIRWAVES

"moments" on either side. Even this isn't technically accurate, but the point is that if you were to cut say the right wing's planform out of a piece of cardboard and move a pencil along the span until the cardboard balanced, then you'd be at the mean geometric chord which, for all practical purposes, is the MAC.

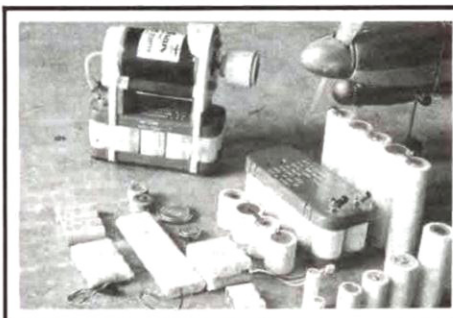
The formula isn't all that complicated as you can see: spanwise location of $MAC = [b(I + 2\lambda)]/[6(I + \lambda)]$, where b = the total wingspan; λ = taper ratio, i.e., the ratio of the tip chord to the root chord.

Depending on the wing's taper ratio and sweep, there can be a considerable difference between the point on the span of equal area (your definition) and the point of equal moments (the correct definition). If you set up your CG using your definition, you could easily miss the true MAC's CG position by quite a lot. I ran some calculations for a variety of swept-aft and swept-forward wings with a variety of taper ratios. I found errors as large as 12 percent forward and 4 percent aft of the true MAC's quarter-chord point. Obviously, ballasting your model 4 percent too far aft might be disastrous.

Fortunately, your "equal area" approximation gives a "conservative" forward CG for typical wing planforms and answers fairly close to the correct values for MAC. Placing

(Continued on page 119)

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AIRWAVES

(Continued from page 117)

the CG too far forward, however, isn't good practice as it increases static stability, which cuts down on maneuverability for a given elevator size and may require extra ballast weight to achieve the CG location.

Your approximation starts to break down for large sweep angles (like 40 percent and greater) and highly tapered wings. I wanted to alert you and other model builders to the potential "gotcha" in your response to Bernie Pisarcik in the March issue.

PAUL METZ
Lancaster, CA

Paul, thank you for the clarification on the MAC; your letter also serves well as a footnote to the article on the MAC by James McClure that we ran in the April issue. One of the most engaging aspects of aerodynamics is that it yields to thoughtful analysis, yet it's the subject of nearly limitless discussion. This is all the more the case when attempts are made to reduce aerodynamic principles to rules of thumb, as we did in our response to Bernie.

We welcome comments from you and other technically minded modelers on matters of aerodynamics that are touched on in Model Airplane News. Readers who have comments that will enhance the technical accuracy of this magazine and help readers build better models are invited to drop us a line. TA

GNOBLE GNAT

I'm writing to thank you for the article on the Gnat. That is one great-flying little airplane. I was the first in the Weequahic R/C Club to build the Gnat. There are three other planes in the air with mine now, and I'm sure there are more on the way.

I have one flight-ready Gnat with two more ready to go in the event that I bury one at the field. The Gnat can be built fast, especially.

(Continued on page 120)

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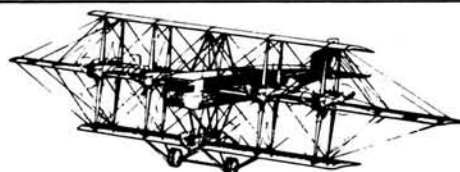
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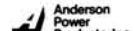
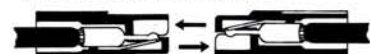
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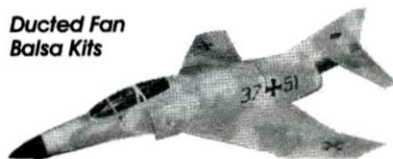
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AIRWAVES

(Continued from page 119)

when I have cut foam-core wings in mass production for the club. Thanks again for the great little Gnat in my hangar.

PAUL SUSZCZYNSKI
Garfield, NJ

Paul, we're very pleased that the Gnat was such a hit in your neck of the woods. We get great satisfaction in knowing that readers are building and flying models derived from our pullout plans. We're planning many more, and each plane will be unique and economical to build. The more value we can give our readers, the happier we all are. Good luck with your squadron of Jersey Gnats. GY

PLANS BY WHITLEY

Just a note to let you and other modelers know that plans and parts are available for my Sea Fury flown at Top Gun. My plans are available: Mel Whitley, 2205 Trinity St., Lynn Haven, FL 32444; (904) 265-6145, or Scale Plane and Photo Service, 3209 Madison Ave., NC 27403; (919) 292-5239.

The plane has an 80-inch wingspan and weighs 22 to 26 pounds when using engines in the 2 to 3.5ci range. Fiberglass cowl, spinner, canopy, etc., are also for sale.

MEL WHITLEY
Lynn Haven, FL

Mel, thanks for the update. I'm sure a lot of our readers will be giving you a call for your plans. Again, congrats on your 1991 Top Gun win.

For interested readers, we're also aware of an 86-inch-wingspan kit that has 1,600 square inches of wing area. The Hawker Sea Fury MKII by Dave's Custom Models, 27B Spring Circle Dr., Austin, TX 78736, is available in a deluxe kit. It includes: epoxy-glass fuselage, sheeted-foam wings, cowl, canopy and spinner as well as a step-by-step instruction manual. Call Dave Nault at (512) 288-2055.

GY

TWIN-ENGINE TILT

I just completed my first scratch-built plane—an F-18 pusher. I learned a lot from the project. The plane turned out so well that my best friend wants me to build him one, even though it hasn't flown.

We've also started construction of an F-82 that's based on two P-51 kits. I built the P-51 fuse first; then I extended the fuses fore and aft and mixed the scratch and kit parts. I scaled the extensions from a three-view drawing of a F-82, and I also scaled the wing from the same drawing and drafted a layout. My friend built the wing for the F-82 using parts from the P-51 kits. So far, everything has turned out great, even though it's being built in two states (Nevada and California).

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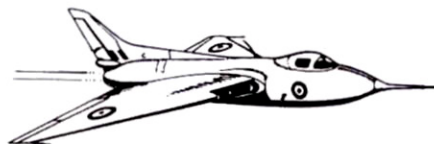
AIRWAVES

Our dilemma is how to mount the two O.S. FP 40s. Should we toe them in or out, and how much downthrust angle should we use? Should we just mount them as specified on the P-51 kit? Obviously, we'd like to get it as close to right the first time rather than guess and lose everything, including good motors and radio equipment. Can you help us!?

BRIAN BRAZIL
Dayton, NV

Brian, your F-82 twin Mustang project sounds pretty interesting. I hope you'll send us some photos for our "Pilots' Projects" column. As far as thrust lines go, keep the downthrust and right thrust specified in the plans for the starboard (right) fuselage, and then set up the port fuselage in a mirror image. Both should have the same downthrust as the kit. For example, if the kit says 3 degrees right thrust, the left engine should have 3 degrees left thrust. This "outboard" thrust setup will improve single-

engine performance if one engine fails. I'd use an engine mount that can be shimmed with washers. It will enable you to fine-tune your model after a few flight tests. Good luck. GY



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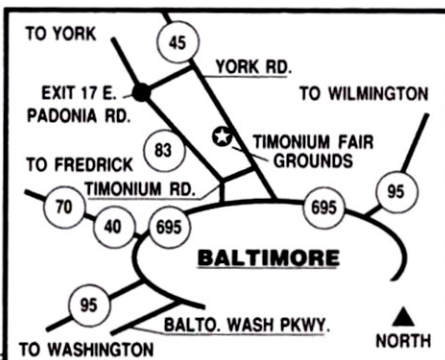
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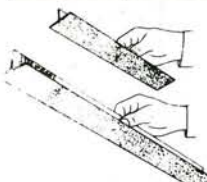


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The March issue of *Tailspins*, which is published by the Dayton Wingmasters, included three articles we thought were "must-reads." The first was: "Let's Get the Best Deal!" by club President Dave Thacker. Dave gave a no-nonsense, one-page brief on the engines he recommends. These were listed under the following headings: "A Winner Every Time Column," "Roulette Column" and "Low-Cost Winners." Dave sagely noted that if an engine requires a lot of effort to get it to run properly, the modeler pays a "fooling-around tax" and that the "highest-priced engines are usually the lowest cost engines."

A second article of interest, by Jeff Shawhan, was an equally concise advisory on the trainers Jeff recommends for beginners. Finally, Ray Wood reviewed Coverite's Permagloss iron-on fabric, which he used to cover a J-3 Cub four years ago. These three pieces were additions to the standard newsletter updates and event reports. We were impressed enough to award two one-year subscriptions to our newest "Club of the Month," the Dayton Wingmasters.

Newsletter editors! Please put us on your mailing lists! We'd like to see a lot more great material and may want to talk to you about reprints.

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ENGINES: IGNITION, GLOW, DIESEL—new, used, collectors, runners. Sell, trade, buy. Send \$2 for large list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555. (619) 375-5537.

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COMPUTERIZED AIRCRAFT PLOTS: Technical illustrations suitable for framing. Three-views. Computer scale drafting and scanning services. Turn old prints into masterpieces! Catalogue, \$1. D-TECH SYSTEMS, Rte. 2, Box 191-14, Carterville, IL 62918.

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MODEL ROCKET with onboard 8mm movie camera! Plans, \$11.95. Reeve Publications, P.O. Box 65752, Salt Lake City, UT 84165-0752.

FOAM WING-CORES, floats, EPS blocks. All foam cut on Tekoa feather-cut system. Will cut to your specifications. Call or send to: SKY BLAZER PRODUCTS, 448 Vienna St., Newark, NY 14513; (315) 331-7464.

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WANTED: Morton M-5 radial for cash. Pre-war Korn, Dooling, etc., racers. Fine machinist's models. Top cash. J. Kramer, P.O. Box 8102, Pittsburgh, PA 15217; (412) 621-3977.

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FOR SALE: Yellow Aircraft F-4E Phantom II/Jet. All-new, original parts; half built; new 5-inch Dynamax Fan; new O.S. 77 engine with tuned pipe; extras included. Asking \$500. Call or write to Tony Liguori, 1062 Pierce Ave., Bronx, NY 10461; (212) 824-3020.

SIGNS • PLAQUES • BANNERS. Choose a sign for your shop, a name plaque for your display case or a banner for your club. For free brochure, send SASE to: Danco Signs, 425 E. Knightsbridge Pl., Lecanto, FL 32661.

MODEL MAGAZINES (1930 to present): *Air Trails*, *American Aircraft Modeler*, *Flying Aces*, *Flying Models*, *MAN*, *RCM* and others. Complete sets and spares available. David L. Brown, 61 Coach Rd., Glastonbury, CT 06033-3237; (203) 659-2412.

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IMPORTED DIESEL ENGINES—AE, Aurora, Cipolla, D-C, KMD, MAP3, MIKRO, MK, MVVS, PAW, Pfeffer, Silver Swallow and USE. Also replica Letmo, Mills and MOVO diesels and rare imported glow engines and CO₂ motors. Ten-page catalogue, \$1. CARLSON ENGINE IMPORTS, 814 E. Marconi, Phoenix, AZ 85022.

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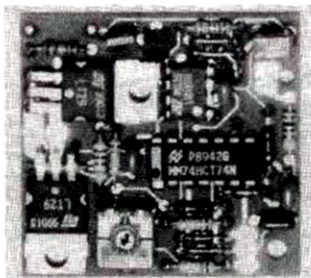
PRODUCT NEWS



UNIONVILLE HOBBIES Canadian Heritage Kits

The Heritage kits comprise two series: semi-scale and scale. Easily powered by .40 to .60 engines, the semi-scale models include a 72-inch Beaver and deHavilland C3 Otter, a 63-inch Nordyn Norseman and two 52-inch bipes. The scale models are larger and use .90 to 1.20 engines for wheel or float operation. The giant-scale kits include a 96-inch Beaver (shown) a deHavilland Otter equipped with a foreflap, an 86-inch Mark V Norseman and an 84-inch J-2 Cub. Write or call for a free brochure.

John Sullivan Model Products, 1421-2nd St., Calistoga, CA 94515; (707) 942-5095.



RK ELECTRONICS Glow-Switch System MKII

Here's a new version of RK's Mosfet Glow Switch (onboard glow driver) for 2- and 4-stroke engines. New features include the unique Actuglow and LoBat detectors that tell you whether the glow plug is working and whether the receiver Ni-Cds have enough voltage for another flight. The unit will function with AM, FM and PCM radios, and the Auto Turn Off will automatically shut down the glow plug if the receiver signal is lost. The system also includes glow battery, charger, glow-head connector, cable, connectors and all hardware necessary to complete the installation.

RK Electronics, 304 Fox Run, Hudson, NH 03051; (603) 882-6022.



TOP FLITE Sierra Trainer

The second model in Top Flite's line of "Gold Edition" kits, the Sierra is a good-looking R/C trainer that performs well and is very easy to build. The computer-designed Sierra's interlocking parts ensure a straight, strong model. The photo-illustrated instruction manual explains everything in a clear, concise way that beginners will understand. The kit also includes a sheet of high-quality colored decals that include windows.

Top Flite Models, P.O. Box 9021, Champaign, IL 61826-9021.



ROYAL PRODUCTS ARF Chipmunk .25

Assemble the Chipmunk 25 in a few hours. It has a sturdy, jig-built, balsa-and-plywood construction, and it's covered with a special, multicolored, polyester film. To increase visibility, the paint scheme is on both sides of the wing and stab. All the surfaces come hinged. Wingspan—49 1/2 inches; wing area—423 1/2 square inches; fuselage length—40 1/2 inches; engine—.20 to .35 2-stroke; radio—4-channel.

Royal Products Corp., 790 W. Tennessee Ave., Denver, CO 80223.



IKON N'WEST 1/4-Scale Ryan PT-22

The 90-inch-wingspan, 17-pound PT-22 flies on a Super Tigre 2500. The parts are all hand-cut, the balsa sheeting is hand-selected, and the intricate landing gear, which includes functional shocks, has been reproduced accurately. For ease of assembly, the wings plug in; 5 minutes at the field and it's ready for flight. Send \$4 for a complete Ikon N'West catalogue.

Ikon N'west, P.O. Box 306, Post Falls, Idaho 83854; (208) 773-9001.



MHT PRODUCTS Electro-File

Use this new, cordless, reciprocating tool to cut, file, sand and shape and make controlled cuts in the middle of a work piece. The light-duty Electro-File is operated by a built-in 3.6V rechargeable battery, and it's useful for a wide variety of applications where the use of rotary tools isn't practical.

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MHT Products Inc., 2755 S. 160th St., New Berlin, WI 53151-3601; (414) 821-0155; 1-800-558-8880; Fax: (414) 821-0144.

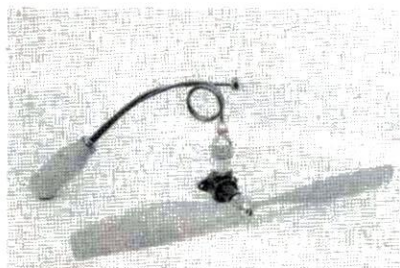
PRODUCT NEWS



HOBBICO Command Servos

Hobbico's Command Servos are available in five styles: mini—for electric helis and small aircraft; standard—for on-road/off-road cars and trucks; standard with Oilite bearings—for all airplanes and helis; deluxe—for aircraft and helis with ball bearings; and large— $1/4$ -scale servos with ball bearings and 130 ounces of torque. Command Servos feature surface-mount technology, indirect-drive potentiometer, Oilite bearings or ball bearings and high torque—all at an affordable price and with a one-year warranty.

Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300; Fax: (217) 398-0008.

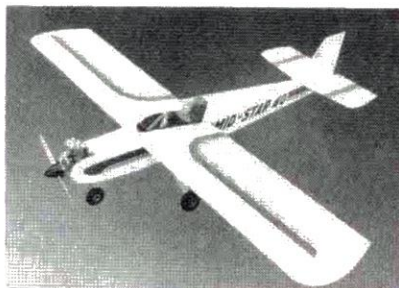


HOBBY LOBBY Modela CO₂ Engine

The Modela CO₂ engine is ideal for small free-flight planes, because it's about $1\frac{1}{2}$ inches high and weighs only 1 ounce, including the tank and prop. It was designed for very light (2 to 3.5 ounces), small, free-flight aircraft with 24- to 36-inch wingspans and 93- to 155-square-inch wing areas. Call or write for a the new Hobby Lobby catalogue (no. 18). It's free in the USA!

Price: \$36.30

Hobby Lobby, 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444.



SIG MFG. Mid-Star 40

The Mid-Star 40 is a dynamic combination of mid-wing stability and aerobatic sizzle. Its gentle, slow-speed characteristics make it an ideal novice pilot's second airplane. You'll appreciate its easy-to-build fuselage and wing, pre-cut balsa-sheet tail surfaces and complete hardware package, which includes pushrods and EZ Hinges. There are also instructions and parts to make the Mid-Star 40 a tail-dragger. Engine—.30 to .40 2-stroke, .40 to .50 4-stroke; wingspan— $64\frac{1}{2}$ inches; wing area—630 square inches; length— $47\frac{1}{2}$ inches; weight—5 pounds.

Sig Mfg. Co. Inc., 401-7 S. Front St., Montezuma, IA 50171; (515) 623-5154; Fax: (515) 623-3922.

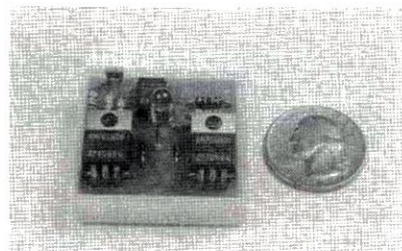


INNOVATIVE MODEL PRODUCTS Hawker Hurricane

This $1/6$ -scale Hawker Hurricane has an 80-inch wingspan and flies on a .75 to 1.08 2-stroke or a 1.20 4-stroke engine. For a scale effect, the fuselage has molded-in longerons. The tail feathers are built up to be covered in fabric, and all the scale details—spinner, props, cockpit kit and retracts with tires—are available.

Price: \$269.95 (plus \$15 S&H)

Innovative Model Products, P.O. Box 4365, Margate, FL 33063; (800) 780-3190.



JOMAR PRODUCTS Ultimate Battery Backer

The 1.5x1.5x0.75-inch, $3/4$ -ounce Ultimate Battery Backer is a solid-state, redundant, battery-switching system. Monitoring two packs, it switches to the backup pack if it detects a fault in the main one, and it can handle up to 20 amps of current! It's available in hobby shops or directly from Jomar Products.

Price: \$49 (plus \$1 S&H)

Jomar Products, 8606 Susanview Ln., Cincinnati, OH 45244; (513) 474-0985.



HOBBY DYNAMICS Manual Fuel Pump

Hey gas guzzlers! Here's a compact, geared, high-volume manual fuel pump that's made of durable glass-filled nylon and works in both forward and reverse. Use it only with glow fuels. For ease of use, it comes with a fuel nozzle and a filtered fuel-can clunk.

Hobby Dynamics Distributors, P.O. Box 3726, Champaign, IL 61826.

Descriptions of products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News**, or guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News**.

NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

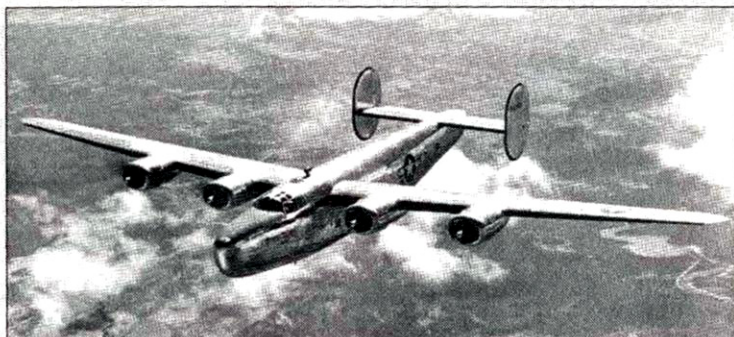
If so, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

Congratulations to 13-year-old Finbarr Cullen of Big Bear Lake, CA, for correctly identifying the mystery plane in the March '92 issue. Finbarr's answer was chosen from 96 correct entries.

Intended for the Navy, the Curtiss XF15C-1 was an experimental, "composite-powered" aircraft, i.e., it had two types of engine: a reciprocating Pratt&Whitney R-2800 engine in the nose



and an Allis-Chalmers H-1B jet engine in the aft fuselage. The Pratt&Whitney engine spun a



13-foot-diameter, four-blade, variable-pitch Curtiss propeller. This T-tailed fighter had a wingspan of 48 feet, a length of 43 feet, 9 1/2 inches, and it was 15 feet, 3 inches high. It had a range of 1,200 miles, a top speed of more than 450mph and a stall speed of 100mph at its 16,775-pound gross weight. With an empty weight of 13,084 pounds, it had a useful load of 3,671 pounds and a service ceiling of over 3,800 feet. The XF15C-1 was the plane shown on the cover of the October 1947 issue of *Model Airplane News*. ■

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to *Model Airplane News*. If already a subscriber, the winner will receive a free one-year extension of his subscription.

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